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From the Director

PROJECT WARRIOR has become a part of the Air Force vocabulary. If you haven't heard it or are only somewhat familiar with what it means you will want to read on. Each of us in Engineering and Services need to understand what PROJECT WARRIOR is all about, relate to it and make it a part of our everyday life.

Since this issue of **Quarterly** is dedicated to readiness, it's only natural that I expand a bit for you on PROJECT WARRIOR and how it relates to Engineering and Services — specifically, to be ready means to be motivated and knowledgeable, but to be motivated and knowledgeable one must understand why he or she serves in the Air Force and what that service entails.

Many of you have heard me say that we live and operate in a peacetime environment but must be ready to transition from peace to war overnight. Over the past several years some Air Force people have come to view their work as an ordinary 8 to 5 job, unrelated to warfighting. This reflects a rather serious misconception of military service and why we wear the uniform, i.e., an attitude identity problem. Related to this is a general lack of knowledge among Air Force members about warfare. PROJECT WARRIOR, a concept that stresses the need to think about why we exist, that is, to fight a war, takes us from the 8 to 5 syndrome, and the emphasis to manage rather than lead, to a plateau that established a new high in terms of improving the war-fighting attitude and knowledge of Air Force people.

PROJECT WARRIOR has two main objectives. The first — to improve the warfighting spirit and perspective of Air Force people — addresses the attitude/identity issue. We know that a dedicated, professional force is essential to national security. Therefore, PROJECT WARRIOR seeks to implant the professional values that have distinguished America's warriors of the part — Duty, Honor, Country. It emphasizes our special responsibility to the nation and the fact that we are all important members of a combat team.

WARRIOR's second objective — to improve our understanding of the theory and practice of war, with particular emphasis on the contribution of airpower, to help us better prepare for the future — aims at the heart of the knowledge problem. We need to know as much about war as any other subject. We must outthink our adversaries if we are going to carry out our responsibilities to the nation.

These are laudable objectives, but how do we achieve them? Through leadership and education. Leadership, particularly at squadron level, is the key to instilling a sense of mission and warfighting spirit in our people and to sparking their interest in the study of war. Commanders and supervisors should encourage participation in educational opportunities oriented toward PROJECT WARRIOR and then set the example through their own participation. Each of us, however, must take the initiative to join in discussion groups, professional reading programs, war gaming seminars and other various WARRIOR activities since the essence of PROJECT WARRIOR is really self-education on our foremost professional subject — warfighting.

To assist in meeting the objectives of PROJECT WARRIOR, we will continue to publish WARRIOR oriented articles in **Quarterly**, similar to several in this issue. Most of these articles will deal with current warfighting topics. In the near future, we plan to publish and distribute a compendium of articles detailing the warfighting history of Engineering and Services. This will become part of the WARRIOR reference library at every base and MAJCOM. Other assistance initiatives will be forthcoming as time passes.

Some may feel that PROJECT WARRIOR is great for pilots, navigators and missiliers or for Generals and Colonels, but not for them. Nothing could be further from the truth. We all have critical warfighting roles in Engineering and Services — officer, enlisted, civilian, and reserve alike — and we need to know as much as possible concerning those roles. We also need to understand warfighting both in a general sense and from the standpoint of other career fields. Only then can we place our warfighting roles, and our on-going preparations to perform those roles, in the proper context.

I strongly encourage each of you to become an active participant in PROJECT WARRIOR. By doing so, you will strengthen our national security and you will gain a greater sense of identity and purpose which will make your career in the profession of arms much more fulfilling.

Project Warrior

CLIFTON D. WRIGHT, JR.
Major General, USAF
Director, Engineering and Services

The E&S people of the Alaskan Air Command are working to create renewed facilities, a new standard for Air Force people serving in our largest state.

Quarterly

AIR FORCE ENGINEERING AND SERVICES

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- Attract highly qualified personnel to the Air Force Civil Engineering and Services career fields
- Promote effective training, education, and retention
- Communicate vital concepts, policies and practices which affect the wartime readiness of the United States Air Force.
- Promote professionalism, and devotion to duty.
- Stimulate planning for the wartime survival of our personnel, weapons systems and facilities.
- Develop Air Force stewardship of the well-being, quality of life and facilities support to Air Force personnel and their families throughout the world
- Promote awareness of the efficient, effective and essential facilities needs of the Air Force.
- Transfer knowledge of Air Force Engineering and Services' technical and scientific achievements.
- Promulgate teamwork among the Air Force Engineering and Services' total force.
- Achieve a professional dialogue to enhance the thought, development and contributions of the Engineering and Services team worldwide.

The **Quarterly** editorial offices are at HQ Air Force Engineering and Services Center, Tyndall AFB, Fla. Contributions, suggestions and criticism are welcome. Opinions expressed do not necessarily reflect the official viewpoint of the Department of the Air Force, the Director of Engineering and Services or the editorial staff. Authority to publish this periodical automatically expires in January 1984 unless its continuance is authorized by the approving authority prior to that date. The use of a name of any specific commercial product, commodity or service in this publication does not imply endorsement by the Air Force.

Project Warrior

Arctic Warrior:

An interview with Lt. Gen. Lynwood Clark

by H. Perry Sullivan, Jr.

ESQ: It seems to me that the Alaskan Air Command has a unique requirement for the civil engineer to support his commander.

GEN. CLARK: They do. There are many reasons for the problems in Alaska. There was the post-Vietnam period. There was a period when we just didn't put enough priority on these kinds of things at the national level. Then there were the programs to cut the military strength in Alaska and reduce remote assignments. It gave the impression that you shouldn't put a lot of money into Alaska. In Alaska, where we have buildings 30 years old which have had a limited amount of money spent on them to upgrade and keep them state-of-the-art, you just can't ignore the need to repair and replace on a planned program basis. It may have been that over the years the planners here — including the engineers — were too easily convinced that Alaska didn't need it or that there was something different about Alaska where they didn't have the same kind of standards for their facilities that the Air Force has for the lower 48. The bottom line is that we were very poorly planned. However, now our engineers are coming on strong. We have a good leader in Colonel Ralph Hodge, our DCS Engineering and Services. He is an innovative sort of guy. He has motivated his people and they are beginning to pick up the momentum. We now have a believable five-year program in the Air Staff called COOL SENTRY. I say it's believable because my observation is that the Air Staff is very, very aggressively supporting it. I think they recognize that there is now a rational, organized approach towards solving Alaska's facility and O&M problems. Of course, BMAR is a great concern to us.

ESQ: That's a good point. BMAR is something that really bares discussion. How do you feel about the BMAR program?

GEN. CLARK: Well, our BMAR program — like our basic construction program — was nonexistent two years ago. At one time, after we began to aggressively pursue this problem, BMAR for the Alaska Air Command was 50 percent of the total in the Air Force because we were first on line. Alaskan Air Command has a problem that's over $200 million and growing. That's very hard to choke down if you are a member of the Air Staff and are faced with presenting the problem to a Congress during a period when austerity is supposed to be the watchword. I don't know what the solution is unless you attack it from my perspective — construct new facilities to eliminate BMAR.

ESQ: The facilities you have, as you pointed out, are in any case 30 years old or in some 40 years old. Do you have a systematic renewal plan now?

GEN. CLARK: Yes, we do. COOL SENTRY encompasses BMAR, O&M repair functions and also our military construction program to build new or replacement facilities. The program now entails $700 million in projects. The things that you see here on Elmendorf are not typical of the rest of Alaska. This base looks pretty good. On our northern bases, like Eielson, we are operating out of some very old buildings. Our A-10 operates out of some buildings that were scheduled for teardown a number of years ago and literally were stripped on the inside. Those buildings have been rehabilitated and we are operating out of them now. And, I might add, we are operating satisfactorily at the minimum level but that doesn't solve the problem. We need new permanent maintenance facilities for our A-10 operations. In the $700 million program that I talked about a few moments ago, there are those kinds of facilities coming on line.

ESQ: With so much territory in your command and relatively a small number of people, it seems that there is a very, very strong dependence — particularly among the remote sites — for electrical power. How do you visualize the challenge of secure, dependable and uninterruptable electrical energy?

GEN. CLARK: Well, we are going to attack it in a very conventional way. We are going to use oil or diesel, and generators. I guess we will use those into the future because it is a manageable process. Some of the more exotic things — solar power and use of gas for example that might be piped in from some location out of the oil fields — are yet so expensive that we just can't begin to use them. Right now, we ship fuel out of Seattle on barges — we call it COOL BARGE — and they deliver fuel and dry goods all along the Aleutian chain and along the coastline of Alaska and across the northern coastline clear over to Barter Island. The products are delivered over the beach by some very professional people. That's the only way to describe it because they pull up to a site and they offload their equipment and pipelines and hoses. They pump the oil ashore and they deliver it in their truck up a road that they bulldoze to the site. They pump it into our tanks and then they load up all their equipment and move to the next location where they do it all over again. It's a sophisticated process and they are good at it — they really are.

ESQ: There has been a tremendous reduction in the overall numbers of contract people required to man the radar facilities and

the number of Air Force people operating and manning radar facilities seems also to be going down. This creates a unique challenge for the civil engineering forces in operating quality assurance and evaluation on contractors. Is it possible to have effective contractor relationships at remote sites with so few people?

GEN. CLARK: I have to say yes. The Air Force has been successful with this concept along the DEW line for many years. We have an advantage over those folks on the DEW line. We are getting some new facilities at our remote sites which will be easier to maintain. Thus it will be easier to keep track of a contractor's performance. This includes a close readout of the performance of the radar modes, i.e., we will have computerized access to the performance of the radar right here at Elmendorf. We can see the degradation of the radar faster than the people at the radar site, because they are sitting at a lower campbase where they do not have that readout. So it's going to be us at Elemendorf telling them that their system is degrading or degraded or totally non-operational. To check the performance of the people in housekeeping or in facilities maintenance, we must have enough people visiting to be able to tell when the contractor is not doing his job. Obviously we won't be able to tell them when the lint ball was formed but if the lint ball is there when we get there, we know that they are not manning the broom quite often enough. Summarizing, I think we will have an adequate control on the performance of the contractor under the new system even though our Engineering and Services people aren't going to be Johnny-on-the-spot 24 hours a day.

ESQ: The Alaskan Air Command is critical to the education and training of people involved in cold weather warfare. The exercises seem to be meaningful and very productive. The civil engineering community supports these. How do you evaluate or estimate the value of the civil engineers to the conduct of the cold weather training exercise?

GEN. CLARK: If it had not been for Major David Tull of the 21st CES, our Bare Base commander, and his troopers, there wouldn't have been an exercise this year. How's that for being positive? At the Clear Creek cantonment area, used in BRIM FROST '83, civil engineers went in ahead of everybody else and built the cantonment area in an environment where you can literally lose your life if something goes wrong. They do a very, very tough job and in a very credible way with equipment that is substandard. Here in Alaska we don't have the kind of cold weather bare base equipment that we should have in our Air Force. Our engineers make do with a lot of innovativeness and aggressiveness. And they are always doing things that add to or improve our capabilities. For example, at this last BRIM FROST we had some folks from Department of Energy who had some Tritium runway lights that they wanted evaluated. They came up here and helped out in the process, but it was our Air Force guys here in Alaska and your people from the Center down at Tyndall that were out there putting the light bases down and the tritium lights in and that kind of stuff. They

are just flat innovative and that is the only way to describe it. They worked in temperatures that ran as low as -55° (measured temperature) and with wind — in addition to that — which brought the chill factor down around -90°. Most people can't even survive in that kind of situation and those guys were up there, putting together a base. I'm proud of what they did and think they have just a tremendous capability. Not a single case of frostbite. Even our Army friends, who spend a significantly greater amount of time out in the cold, and are theoretically the experts in this, had frostbite cases. We had zero! And again, that is a real credit to our engineers. Good bunch!

ESQ: I understand the State of Alaska had quite an interest in Tritium lighting.

GEN. CLARK: Yes, for the same reason we do. They often need lights at a bush airfield but have no readily available electrical power sources. Of course you don't have to have electrical power when you have the tritium lights. We need something when we deploy into bush locations with minimum airlift support. With the A-10 we acquired quite a capability that we've never had before in the fighter business. That is, we can put those A-10s out into the bush and support the Army and scouts where they are. We couldn't do that with the F-4 because we had to have a long runway and support shop sophisticated that it took dozens of airlift C-130s to get into that particular field if you deployed. We can deploy with one C-130 load of equipment and support a very significant operation with our A-10. But, when you go to those locations, if you have to carry an airfield lighting system with you, your airlift requirements are expanded — fuel, a generator, a fantastic amount of wire and weight and lights and those kinds of things, and you carry people to keep the equipment working. To solve our airfield lighting problem we need to get in there with relatively low amounts of airlift. Tritium lights are just super because you can carry them in a suitcase. The State of Alaska fits into that category. If they want to light a field, right now it's very expensive proposition — to turn them off and on, service the generator that services those lights, etc., etc. With tritium, you don't turn them out.

ESQ: There seems to be a real strong magnet type attraction for people to return to Alaska once they have been here. Is there anything that you think is behind this attraction?

GEN. CLARK: I would be speculating if I were to try and answer that. If you ask people to their faces they say, "Well, I like to hunt and fish," or "Well, I had a good time in my assignment the last time I was here;" or "Well, my family likes it." It's probably a combination of all those things. There might be one other factor — maybe they just like to be pioneers. They like to innovate, they like to face the elements and figure they beat them to some degree. I don't have a good answer to your question. Is it poor judgement or because it's a rewarding, challenging experience?

ESQ: In terms of life quality, is there a fairly progressive program here in Alaska to treat the quality of life available not only for the airmen but for the families?

GEN. CLARK: I think so. Now again, we're a long ways behind but we're putting a lot of money into quality of life items this year and we will continue to put a lot of money into them until all of our dormitories are upgraded to the Air Force standards, or — as a minimum — DoD standards. On Shemya, where there was no attention at all, we're hopeful that we can pick up two 160-person dorms which will relieve to a significant degree our problems of both transient and permanent party housing. We have spent nearly $8 million dollars in renovation on the dormitories at Shemya in this last year and a half. The money resulted from pictures that I carried to the Pentagon on one of my trips. I showed them to the Vice Chief of Staff. The pictures showed holes in the casements of the windows where you could look right straight outside. It impressed him. I asked him to stop at Sheyma for several hours on his way to

Japan and take a look at the situation. He did. When he got back on the airplane enroute to Japan — he relayed a call back to General Gilbert and told him to give us the money we needed in order to replace all 640 windows in that particular building. That got the ball rolling at Sheyma. My concern is that the rest of the world doesn't even understand what our people problems are here. Let me take you off on another tangent. At Galena, which is one of our forward operating bases we have aircraft on alert 24 hours a day, seven days a week. We have some dormitories, a feeding facility, and a couple of MWR buildings and the like. These are kind of intermixed with local native buildings and houses, junk everywhere, no paved roads, no control at all over the environment that our people lived in. Our AF people depend on us to give them some privacy, a place to call home, which they can share with their Air Force friends and associates. But, our guys and gals were living in that kind of an "open arena" and it seemed too tough a problem to solve. But it wasn't. All we had to do was get determined and we got some P341 monies to build a fence around that place. We also disconnected private buildings from our utilities and services. What this all leads to is quality of life for our people. Our people were put into that situation for a year. They also lived in the muck and mud and nobody would bite the bullet. It was too expensive to solve. I made them build sidewalks. At first I was told it couldn't be done because of the frost and all. But now they have built some sidewalks the hard way with a small mixer. Now, people will walk across the road to walk on that sidewalk. That's proof of the pudding, if you give people something decent they will use it. People down in the lower 48, who never experienced that, don't understand what quality of life up here means. They think of it in terms of new drapes or bedspreads on the dormitory beds, or carpeting on the floor of the dormitory, or "Have I got 120 square feet for each individual?" This is fundamental — I have given them hard ground to walk on so they are not walking in mud. Nobody had ever been willing to step up to it and say "We're going to solve that problem." It is being done now. Civil engineers are working the problems the right way and we're going to have a better command as a result.

ESQ: What about food quality?

GEN. CLARK: I think you would be very pleased with the quality of food. Our people eat well and they get pretty much the fresh fruits and vegetables like what they get in the lower 48. Now, there are some exceptions to that. For example up in Cape Lisburn the people have at times gone for — oh — three weeks or longer where we couldn't get an airplane in to support them.

Obviously you can't get up there any other way than by airplane — there are no roads and boats don't float on ice. So there are times like that when they don't have any fresh vegetables left, but several things have helped us counteract that. For example, the storable milk is a real boon to the system because now you can put milk out there and leave it.

ESQ: Back to housing for a minute. One of the mental images of Alaska is high housing costs. Is there anything moving that will improve the ability to have some better availability of housing for people coming with their families to Alaska?.

GEN. CLARK: Yes. Our initiative in that particular area is at Eielson where the problem is at its worst. We're attempting to get private financing for construction of houses to lease to military folks on Eielson AFB. This requires legislation to allow us to lease back from private entrepreneurs for an extended period of time. The 10-year limit under the current law won't cut it because we can't pay back fast enough to let the private entrepreneurs recoup their money plus a reasonable profit. In order to make this a viable thing at Eielson we have to make several things available to the private entrepeneurs to get the price down low enough so that we can pay off in a reasonable length of time. We have to provide them with the water and sewage utilidors and the hookups to electricity. These things are extremely expensive in

Alaska. Here is why. Unless you can tie on a city or a base sewage processing system there is no way you can afford to build a housing development. Permafrost won't allow you to do put down septic tanks. Sewage freezes up before it gets to the processing plant unless it is in a heated utilidor. If we don't have that utilidor system paid for by the United States Air Force the housing cannot happen. And we have got to solve that problem before the private financing becomes a viable approach. But we are aggressively pursuing it. To get change we must tell the people and their congressional delegations, the Air Staff and the DoD. Only they can get those utilidors started. Here in the Anchorage area housing is in short supply momentarily but there is a lot of construction going on. Just a couple of weeks ago I saw an article in the newspaper that mentioned overbuilding, and that may be true. With the variable housing allowance system it is possible for some of the higher ranking people to get out in the market and buy a house and still keep their nose above the water line. For young airmen the cost is very high and they don't have the down payment or the income to qualify for homes here in the area. So, they hurt unless there is something on base. Taking the pressure off on the top side often times opens up base housing for these folks. It wasn't but a year and a half ago when people were moving off the base and we had vacancies. You could walk in to Elmendorf and get a house the minute you put your name on the list. I don't know if it will ever back to that completely but the pressure is coming off now.

ESQ: There have been numerous environmental challenges here at the Alaskan Air Command. Do you feel that there is an adequately aggressive program to identify and categorize and recover from those environmental problems.

GEN. CLARK: To anwer your question specifically — yes, there is an adequate identification of the problem, but to recover? The answer is "No." We have a phenominal problem here — cleanup of the White Alice communications sites. It would cost us millions and millions of dollars to do it completely. We have cleaned up a significant amount of PCBs and other carcinogens at our White Alice sites. We still have two or three to go and those are programmed for this summer. But we're doing it on a shoestring budget. We do it with opportune airlift and sealift and a lot of innovativeness and ingenuity on the part of our civil engineers. They're sending small teams out to do this clean-up. But, we just don't have the money to do the entire job and I don't think that we're special in that category. I think that's a problem that exists all over our country. I don't know how to further quantify it other than to say that "Yes, it's a big problem and no we don't have a solution."

ESQ: What can you tell our civil engineering and our base services people as to best being able to adjust to your philosophy, your way of operating, your way of doing things? What's the best word to the wise?

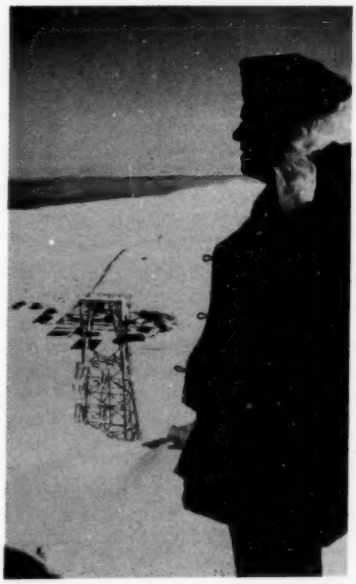
GEN. CLARK: Look for quality in leadership and put it in charge. When you see quality, move it, promote it, give it the opportunity to spread its wings and excel. The problem in the Alaskan Air Command has been one of lack of adequate leadership at the very top. If you don't have it there, I don't care how innovative and aggressive and dedicated your people are, they just can't get the job done effectively. The way that you get productivity out of your people is to start at the very top with the right kind of thinking, the right kind of planning, the right kind of leadership, the right kind of motivating of subordinates, the right kind of programming with the Air Staff and the other agencies at the top where the dollars come from. It has to start at the top. The quality has to be there at the top. There's so much talent in the civil engineering field still untapped that bubbles to the surface if you just get the stumbling blocks out from in front of them and let them go. If you just give them the opportunity to excel, they will. I think that's what I'm seeing here in this command right now.

ESQ: Are civil engineers especially important to the Alaskan Air Command?

GEN. CLARK: Probably more so than other commands because things break easier here and break more often and, if it does break, sometimes it can be catastrophic. If you lose your heating plant here for very long, you freeze everything up instantly in the cold, dead of winter. If you lose your heating plant in Arizona, you can live without it for quite a while. Yes, it is more critical here because the environment is tougher on us. But engineers have the same kind of job and it's equally important anywhere you go. I don't want to sound dramatic. What I'm saying is, "Yes, they've got a tough job here, but certainly other engineers have tough jobs elsewhere, too." I'm not trying to say, "Hey, look, we're magic" or anything like that because it's not true.

ESQ: What's the most difficult issue, the most difficult concern of yours in communicating with the people in the Pentagon and the people on the Hill when it comes to understanding Alaska.

GEN. CLARK: Basically, the standards in Alaska that have been acceptable in the past are so unbelievable that people don't understand them when you talk about them. They don't believe it. They don't understand what it is to have no roads, to have no sidewalks. They can't comprehend that. I find that trouble right here on my own staff. I went three times to the watering trough with my civil engineers a while back concerning roads on Sheyma. The standard mind set is that we don't need roads on Sheyma and that is because we don't have roads anywhere in Alaska. (After you've been here for about two months, you begin to think that way.) Then, I finally found the thing that I could relay to people who question the need for roads. Do you know of a single Air Force base in the lower 48 that has either a primary or a secondary road that isn't paved? A primary or a secondary road that isn't paved! Suddenly the dawn begins to light. Outside Elmendorf and Eielson, we don't have primary and secondary roads paved at all. That begins to sink in. It is something that people could relate to. Communications problems with the Air Staff? You asked a kind of two-pronged question there. Really I find the Air Staff has been just magnificent in supporting us once we got our act together here in Alaska. Once we presented our COOL SENTRY program to them and explained it adequately we made a good start with the $490 million in it. We're up to $700 million now. These things are necessary. We're putting together a program and building it in a way that makes sense. I think, this made the Air Staff our strongest advocate.



Project Warrior

Arctic Renewal:

E&S Challenge for Tomorrow

The man responsible for the defense of Alaska is Lt. Gen. Lynwood Clark, commander, Alaskan Air Command. All told, there are approximately 23,000 military personnel to do the job, and of these 10,400 people belonging to the Air Force.

- Alaska, our 49th state, is larger than the entire eastern third of the lower 48 states.
- It is the least populated state
- Topography ranges from sea level to more than 20,000 feet
- It is closest to the Soviet Union
- It is the only state of the U.S. to have part of its territory occupied by enemy forces during World War II (Kiska and Attu).

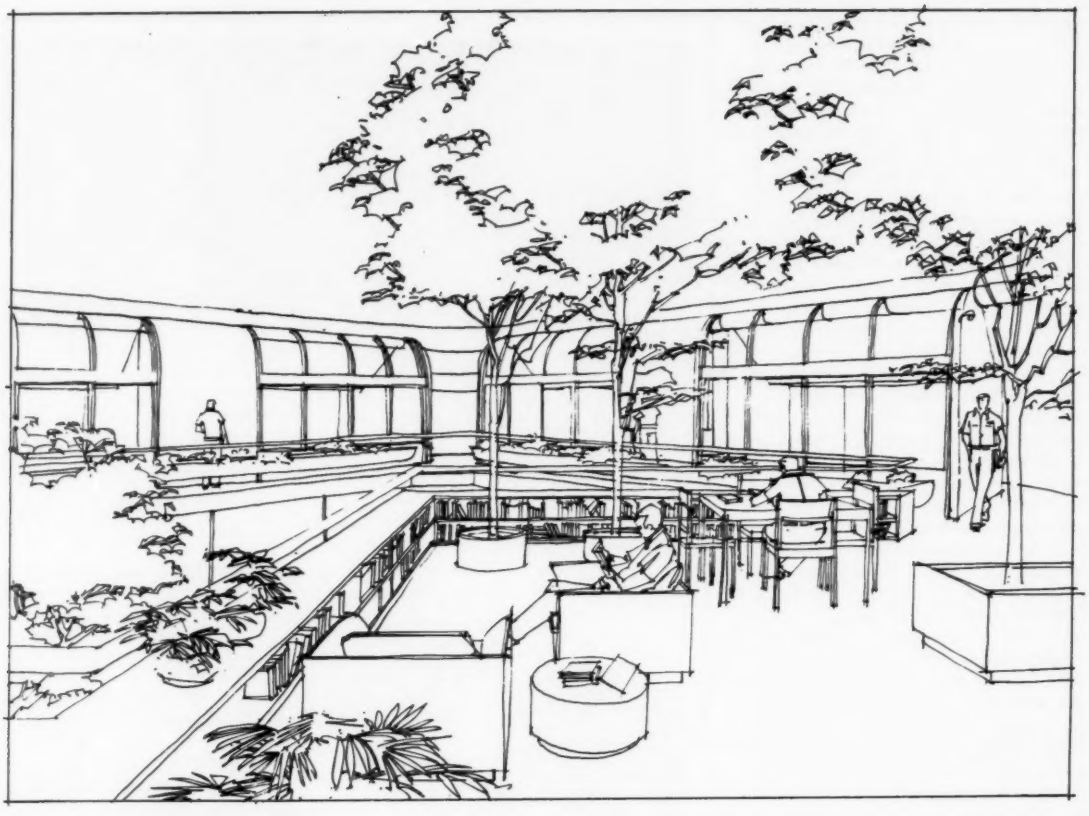
Currently, Alaska is coming out of a transition that will bring it to new standards. The standards include better dorms, housing, eating facilities; improved to greatly modernized mission facilities; and recognition that Alaska is both a frontier with a super-power potential adversary, and a rapidly growing state with increasing social and economic importance.

Project name for most of the upgrades and renewals is COOL SENTRY, currently valued at $700 million combined Military Construction Program and Operations and Maintenance budgets. The man responsible for implementing COOL SENTRY is Col. Ralph Hodge, deputy chief of staff, Engineering and Services. When you discuss the program with Colonel Hodge, you are reminded of numerous aspects of the Southeast Asia. Unlike Vietnam, which had little to no infrastructure at the beginning, there was one in Alaska. However, it was in terrible condition driving base maintenance awaiting repair. Some of the changes driving the overlays of new construction and large repair and modernization projects are:

- Closing the White Alice communications sites with the advent of satellites, leaving a major environmental challenge to dispose of debris and hazardous wastes.
- Converting the remote radar sites to minimally attended facilities which are virtually all contractor operated.
- Bringing on new mission aircraft, including the F-15 and the A-10.
- Admission that not only are we on Shemya for the long haul, but our people deserve better facilities in the same sense that multi-million dollar aircraft employed there require better support.

In Alaska, where some facilities go back to World War II days, costs for maintenance escalated violently with the "pipeline economy." For some, there was the sense that the Air Force was putting in good money after bad on facilities that would ultimately be replaced or abandoned. As a result, living and operating conditions bottomed out. When Gen. Robert C. Mathis (USAF, Ret.), formerly Air Force Vice Chief of Staff, visited Shemya in the fall of 1981 for a first-hand glimpse of living conditions and mission support facilities, he found multi-million dollar equipment housed in old and inadequate facilities; highly trained people living in dorms which were air conditioned in the depths of winter by rotted holes in sills and casements. When an old toilet cracked, it wasn't replaced, just removed. Dining facilities needed more work; dorms required extensive renovation. General Mathis initiated immediate and long-term actions to remedy the situation. Immediately there was a two-phased $5.6 million project, Phase I of which was $2.5 million worth of window replacement, upgrading of 259 dorm rooms, refurbishing the dining hall kitchen and performing other badly needed repairs and improvements. The program has grown to include replacement or renewal of critical mission facilities, paving of roads, added power capabilities, better transient dorms to support workers, and improvements to MWR facilities.

Getting the job done in Alaska is a particular challenge to E&S people because of narrow time windows in which any meaningful work can be achieved, and the requirement to forecast needs in sufficient time to identify, fund and physically acquire materials and the services of contractors. A further limitation is the supporting infrastructure. To insure that his small staff could work such a massive program,



LIBRARY AND ATRIUM

Colonel Hodge established procedures which:

- Identified and justified all major requirements to the Air Staff directly through the Commander.
- Gave programmed requirements top priority tracking.
- Provided direct E&S support to the forward operating bases.

The latter was formerly known as Off Base Civil Engineering, a detachment under the Elemendorf base civil engineering organization. Colonel Hodge found that Elmendorf problems should be handled separately from off-base problems. Further, there were the inherent problems of advocacy and communication when an organization with so important a mission is under a base-level function. What resulted was the creation of the 5099th Civil Engineering Squadron under Lt. Col. Ted Alexander. (Colonel Hodge smiles when he refers to the 5099th as his "RED HORSE.") Colonel Alexander reinforced methods to improve the effectiveness of the 5099th basic mission – providing high quality support to the limited civil engineering components at the FOBs. Each FOB BCE and commander participates in a weekly conference call with the 5099th, in which supply, budget, work orders, anticipated problems, transportation and logistical needs affecting civil engineering are discussed. On the Elmendorf side of the call are all of the division chiefs in the 5099th and the supporting key people. Minutes are maintained on each call, and priorities are assigned to each item discussed. This becomes a valuable tool for follow-up and identification of needed actions.

It should be understood that the 5099th has many non-traditional roles and capabilities. For instance, the squadron runs a depot-level diesel and electrical equipment shop. Almost all electrical energy in Alaska is produced by Air Force facilities for its own use. Reliance on diesel/electric capability is a life or death matter. The 5099th shop not only maintains an ambitious overhaul program, but monitors units in the field. If an activity gets too close to inadequate capability, it is possible to airlift a swap-out team to the site, or handle field repairs with an air-transported team.

To answer the immediate need for upgrades on Shemya, the 5099th was tasked for most of the work involving windows, reworking dorms, upgrading sanitary facilities and dining halls. There is the saying that the 5099th handles programs which don't make as major contracted efforts. While this is true to an extent, it should be realized that the trade off is waiting for a line item, or taking it out of resource. The judgement call is whether or not the condition is tolerable, then, get the attention of the top level decision makers, and get the job done.

Some programs fall to the 5099th which are difficult to handle. The cleanup of the White Alice sites is an example. The problems range from excessive litter to PCBs. To attack the problem, the 5099th identifies the hazardous waste, isolates the area, and sends in small TDY teams to take out the contaminated soil. In the meantime, transformers and other equipment containing PCBs either have been removed or are being removed. The teams require airlift to get in and out. This compounds the expenses greatly.

General Clark points out that the elements of any given program must move

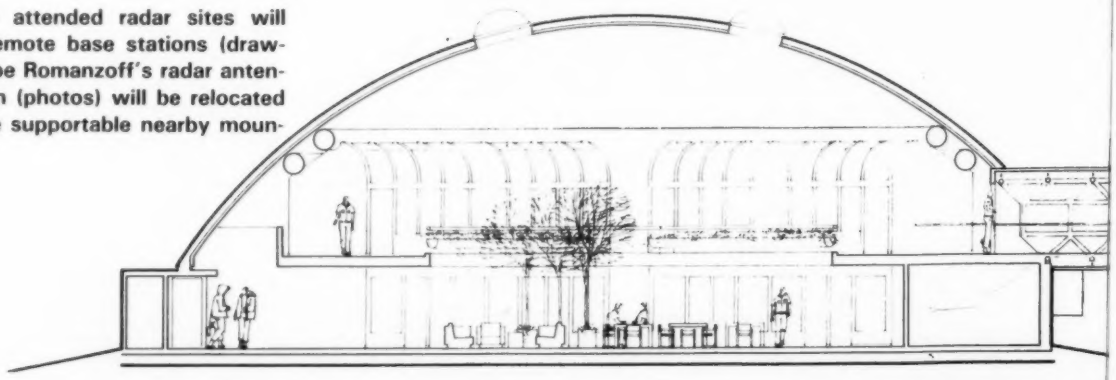
together to be effective. Getting special work done is particularly challenging because it poses issues that must be resolved involving time, transportation, availability of teams, and in the case of the removal of hazardous materials, compliance with stringent environmental laws.

Implicit in General Clark's communications was the fact that the various line items in the program had to move together to be productive, and that to get anything done in Alaska requires long lead time planning. For instance, the limited highway system and the small railroad system make reliance on sea and airlift critical. Virtually all resupply of the Alaskan remote coastline and the Aleutians is through a jointly managed project with Air Force Logistics Command known as COOL BARGE, based at the Air Force Water Port Liaison Office, Seattle, Wash. Materials are received at the Seattle warehouse from AFLC's air logistics centers, the Defense Logistics Agency, the Army depot system, the General Services Administration and from commercial vendors under government contract. Recipients include all of the armed forces and the federal departments with activities in Alaska. On any given project, the materials must arrive at the warehouse from the late fall to the early spring for processing, documentation and, containerization leading to shipment. Shipments begin with the first commercially contracted barge train in the spring serving the lower coast, and terminate in the fall with the return.

Colonel Alexander points out that materials tied to projects may be useless unless the billeting requirements are met for workers. Shemya, for instance, is so constrained in space that a work team must leave before another arrives. Similarly, if a project's supporting materials are purchased and delivered, it is useless unless the contractor is on site.

Just as the civil engineers face transportation problems, so do the services members of the team. Maj. Wes Ardis points out that the meats sent by COOL

Minimally attended radar sites will replace remote base stations (drawings). Cape Romanzoff's radar antenna system (photos) will be relocated to a more supportable nearby mountain.



BARGE in refrigerated van storage must necessarily be the last in at the wholesale warehouses. Even if the reefers are last loaded in April and May, in many cases they will not be off-loaded until summer and the meats won't be used up until the next summer. This required direct negotiation and communication by both General Clark and Colonel Hodge at the Defense Personnel Support Center, Philadelphia. Another problem was in airlift of fresh fruits and vegetables. Working with the Air Force Commissary people in San Francisco, it was possible to work out a system similar to that employed over the years in the resupply of Greenland. Igloo packs of consolidated perishables now carry the foods, each container destined for a given base; not to keep them cold but to prevent freezing while transitioning cargo from airlift.

With space critical, milk uses up both payload and cubic displacement aboard aircraft. When milk not requiring refrigeration was made available, it freed aircraft space for other needed items. This space is especially important to preserving nutrition and the highest possible meal quality during the winter months, particularly since the periodic fresh fruits and vegetable shipments may be postponed at any time due to weather.

General Clark's message is simple. MCP, O&M, people programs are all one in Alaska. People carry out the mission. Every line item in the large and complex program is essential. Colonel Hodge's people watch the funding carefully, ready to rejustify and resubmit. On Shemya, for instance, funding levels rarely meet the requirement. In FY 82, $89.5 was requested, $64.4 funded. This caused an inversion in FY 83, when the carryover projects brought funding to $59.1 million, where only $16 million was requested originally. However, total funding needed when late-starting projects were identified and documented hit a requirement level of $140 million.

Is there a message for the rest of the Air Force? Colonel Hodge points out that drawdowns, mission modifications and changing programs take far more thought, management and detailed analysis than some buildups. Considerations include:

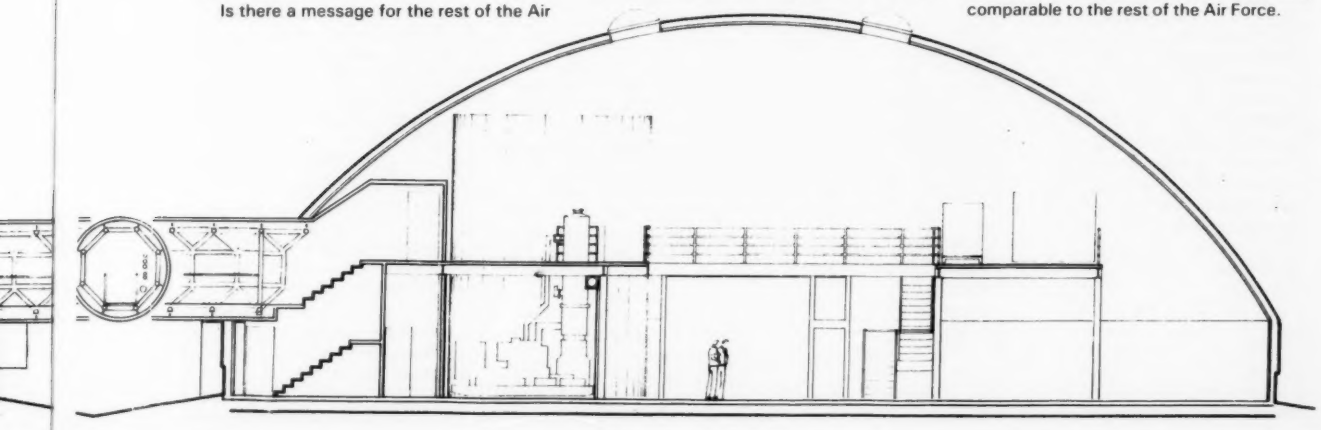
- The levels at which phased-out facilities will be maintained.
- Alternatives to continuing the use of "red X" facilities.
- Early funding decisions and "package" program advocacy on growth areas.
- Clear appreciation of quality of life in the transition.

In Alaska, he points out, a very few people have an unbelievable responsibility. For instance, the base civil engineer at Elmendorf is faced with a BMAR totalling $148 million. Even in the face of enormous backlogs, one mission still must go on. The BRIM FROST exercise each two years takes the Prime BEEF/RIBS forces to Clear Creek for arctic warfare training support. This year, the wind chill got down to -90° and strong enough to blow the tents down. Also, the ice bridges didn't work, impeding moving equipment. This exercise occurs during the worst weather at Elmendorf and Eielson.

To a lesser degree, the support to training continues all year. The command hosts and participates in Navy and other joint service exercises. It is a training ground that stresses all base facilities. The bottom line is that all organic and contracted work must be programmed, funded, tracked down to the base, and scheduled during the narrow season. But, as the physical work begins, the higher summer training cycle begins with incoming forces representing the 'Guard, Reserves and other operational elements. There is a benefit to "training." 'Guard and Reserve E&S teams make a valuable contribution to Alaska, handling base-level projects in the two week training period, while on training deployments from the lower 48. The reserve forces get Alaska experience, AAC/DE gets highly competent forces airlifted in for realistic training that helps reduce the BMAR level.

As General Clark notes, the answer to BMAR is renewal. Only with renewal and a good level of facilities reliability and reduced maintenance can the existing base and command E&S people begin to handle work and the added requirements with anything short of "Vietnam era" work shedules.

Up at the Command, as I dropped in to say goodbye, Capt. Christopher Bupp, the chief of the maintenance management and industrial engineering branch, sat in his office explaining the multi-layered programming challenge. Outside is a huge, unoccupied office bay once populated by E&S people. Three branches each have offices clustered in one corner of the space. It is a graphic illustration that the long delayed renewal for Alaska is being managed by a very few, highly dedicated people, who are working at a level of 10 on a scale of one to 10. But their work will insure that future Arctic warriors will have a standard of facilities, and a quality of life that are truly comparable to the rest of the Air Force.



ESQ world

People, Places & Events of Interest

Design Awards Announced

Twelve projects were honored for design excellence in 1982 by the Air Force Director of Engineering and Services.

Maj.Gen. Clifton D. Wright Jr., announced honor awards for projects at Vandenberg AFB, Calif.; Royal Air Force Alconbury; Fairchild AFB, Wa.; and Buckley Field, Colo.

He announced merit awards for Lackland AFB, Texas; Brooks AFB; Patrick AFB, Fla.; two at Travis AFB; Carswell AFB; Minot AFB, N.D.; and Truax Field, Wisc.

William A. Brown Sr., chief of the Architecture and Engineering Branch, said that there were 125 projects submitted this year. Jurors were William A. Rose Jr., White Plains, N.Y., and Samuel A. Anderson, Richmond, Va., (American Institute of Architects); Peter L. Beal, Washington, and Richard G. Conklin, Los Angeles (Society of American Military Engineers).

The awards below include the project name, location, commander under which the work was done, base-level organization (when appropriate), the organization to use the facility, design agency, the Air Force Regional Civil Engineering Office (when appropriate) and the architect.

Completed Projects:

(Honor Award) M-X Integrated Test Facility, Vandenberg AFB, Strategic Air Command; to be used by Headquarters Ballistic Missile Office; AFRCE/BMS; Sacramento District Corps of Engineers; Reid & Tarics Associates, San Francisco.

(Merit Awards)

• Dormitory, Lackland AFB, Air Training Command, 3700th Air Base Group; AFRCE/Central; Ft. Worth District Corps of Engineers; Foster & Meier Architects, Dallas.

• Dormitory alteration, Brooks AFB, Air Force Systems Command, 6570th ABG; AFRCE/Central; Ft. Worth District Corps of Engineers; Richard Armstrong Architect, San Antonio.

• Officer's club alteration, Patrick AFB, AFSC, 6550th ABG; Fuglebert & Kock Associates, Orlando.

Concept Projects:

• RAF Alconbury medical/dental clinic, RAF, Upwood, Cambridgeshire, the United Kingdom, U.S. Air Forces in Europe, 10th Combat Support Group; Health Facilities Office, Ruislip Department of Environment, Property Services Division; Percy Thomas Partnership, Nottingham, U.K.

• Tanker alert facility, Fairchild AFB, SAC, 92n CSG; AFRCE/Western; Sacramento District Corps of Engineers; Environmental Concern Inc., Spokane, Wash.

• Communications-electronics training complex, Peterson AFB, Air National Guard, 154th Tactical Communications Group, Colorado ANG, 140th Civil Engineering Flight, Buckley Field; AFRCE/Central; U.S. Postal and Facilities Office; Anderson Architects, Roybal & Associates both of Denver.

(Merit Awards)

• Commissary, Travis AFB, Military Airlift Command, 60th ABG, Air Force Commissary Service; AFRCE/Western; Cromwell, Truemper, Levy, Parker and Woodsmall Inc., with Shapiro, Okono, Hom and Associates, both of Little Rock, Ark.

• Commissary, Carswell AFB, SAC, 7th CSG; Air Force Commissary Service; AFRCE/Central; Cromwell, Neyland, Truemper, Levy and Woodsmall Inc.

• Chapel, Travis AFB, MAC, 60th ABG; Office of the Chief of Chaplains; AFRCE/Western; Western Division of Naval Facilities Engineering Command agent and architect.

• Composite Medical Facility, Minot AFB, SAC, 91st CSG; Health Facilities Office; Central Region, Omaha District Corps of Engineers; Flad and Associates of Madison, Wisc., Inc.

• Operations and Training Facility, Truax Field, ANG, 115th CEF, 128th Tactical Fighter Wing; Wisconsin ANG; AFRCE/Central; USP & FO, Flad and Associates.

Lackland Wins Innkeeper Award

The Services Division of the 3700th Air Base Group at Lackland AFB, Texas, was presented the 1983 USAF Innkeeper Award by Maj. Gen. Clifton D. Wright Jr., Director of Engineering and Services, Headquarters USAF at the March meeting of the Program Review Committee at Kelly AFB.

Runner-up in the competition was the services division of the 314th Combat Support Group, Little Rock AFB, Ark.

The award is given each year to the base services organization with the best overall billeting program. The competition places significant emphasis on efforts undertaken by installations to improve their transient facilities, furnishings and services.

Evaluators took into consideration overall facility and management of billeting functions, facility and services improvement plans; billeting desk administration; housekeeping standards; funds management; supply and equipment program; furnishings management; staff personnel appearance; training and motivation programs; and administrative support.

Nine base services units were in competition for the award, all nominated from major commands in the U.S. and overseas.

Evaluators responsible for making the final selections were Lt. Col. James Rizek, Air Force Engineering and Services Center, Tyndall AFB, Fla.; Capt. Barbara Bartley from the Directorate of Engineering and Services, HQ USAF; and Tom Keegan of the Air Force Military Personnel Center, Randolph AFB.

Major Selected "Best" in Energy Conservation

WASHINGTON (AFNS) — The 1982 Department of Defense Achievement Award for medical energy conservation was won by an Air Force major in the Medical Service Corps.

Maj. Gordon W. Best, an architectural engineer with the Air Force Medical Service Center, Brooks AFB, Texas, won the Health Affairs Superior Achievement Award for his design of the new 30-bed hospital at Osan AB, South Korea, now under construction. (See ***Quarterly*** Winter 1981-82 issue, "Making Sure You Can Yell Medic! Survivable Medical Facilities.")

The annual Department of defense award is given to a person or organization from the Army, Navy or Air Force for superior achievement within the Defense Department health-care system.

Major Best's design used energy concepts such as underground construction, earth protection of aboveground walls, special windows and zoning of ventilation

systems.

Acting Assistant Secretary of Defense for Health Affairs, Dr. John F. Beary III, said on presenting the award that the major pioneered a design concept that can be applied to overseas military hospitals in the future.

Kirtland Offers Largest Kiddie Center

KIRTLAND AFB, N.M. (AFNS) – Ceremonies at Kirtland May 6 marked the opening of the largest Air Force child-care facility contained in one building.

The new center covers about 27,000 square feet and will serve 500 children ages six weeks to 10 years. Child care previously done in seven separate centers is now consolidated into one building.

The center includes five infant-care rooms and nine child-development rooms. Each room is self-contained and opens into individual play yards designed for each specific age group. In addition to a large lobby, the facility has a commercial-size kitchen and a large multipurpose room for parents' meetings, gymnastics, music and special events.

The facility cost $1.9 million and was paid for through the Air Force Central Fund and with non-appropriated funds generated through recreation and base exchange operations.

Shaw AFB and Sant have also been nominated as the Air Force's representative in the Secretary of Defense Natural Resources Conservation Awards selections. Robins AFB has been nominated for the Secretary of Defense Environmental Quality Award. These two awards are multi-service opportunities to be acknowledged for outstanding contributions in conservation practices.

SERVICES OUTSTANDING PROFESSIONALS OF THE YEAR, 1982

Lieutenant Col. Robert J. O'Such received the Outstanding Services Senior Manager of the Year award. Colonel O'Such is commander of the 438th Services Squadron, McGuire AFB, N.J. He was formerly a C-141 instructor pilot, MAJCOM staff officer and Presidential Advance Agent. He has graduated with distinction from AFROTC, Squadron Officer School, AFIT Masters Program and the Armed Forces Staff College.

Captain Patrick D. Eagan is the 1982 Outstanding Services Manager of the Year. He is currently the commander and base chief of the 43rd SVS, Andersen AFB, Guam. Previous assignments include Headquarters Strategic Air Command with the deputy chief of staff for Engineering and Services as a member of the CESMET and chief of the Services Division; the 7th Combat Support Group, Carswell AFB, Texas, as the Services Division Officer; Osan AB, Korea, as base food service officer; and the 321st Combat Support Group, Grand Forks AFB, N.D., as base food service officer.

Selected as Outstanding Services Superintendent of the 1982 Year was **MSgt. Elroy W. Vaughn.** He is presently chief, Services Division, 401st CSG, Torrejon AB, Spain. Sergeant Vaughn's assignments include RAF Alconbury, the United Kingdom; Travis AFB, Calif.; Nha Trang AB, Viet Nam; Boron AS, Calif.; Hamilton AFB, Calif.; Hickam AFB, Hawaii; Iraklion AS, Greenland; and Hessisch Oldendorf AS, Germany.

Staff Sgt. Lawrence E. Hornback was selected 1982 Outstanding Services Technician of the Year. He is the NCOIC of billeting, 600th CSG, 600th Tactical Control Group, Hessisch Oldendorf AS, Germany. Assignments include Fairchild AFB, Wash.; and Rickenbacker AFB, Ohio. Sergeant Hornback was an honor graduate of the USAF Billeting Management Course and is currently pursuing a degree in Business Management.

AFIT and the USAFA Offer Career Growth Through Video Training Tapes

by Sgt. Lea Blake
Associate Editor

One of the most important steps in the career of the engineer, whether they be military or civilian, is to become a PE (or Professional Engineer) and state registered. To do this, one had to take the Engineer-in-Training (EIT) exam. Before taking the exam, however, one must study. Recently a program was developed to assist those engineers presently not state registered or holding a PE title by the Air Force Institute of Technology and the U.S. Air Force Academy.

Following a 75 percent passing rate on the Colorado EIT exam by the class of '83 engineering majors at the academy, the Department of Engineering there and AFIT officials decided to make this training available for use by engineers Air Force-wide. To do this, the academy developed a series of instruction tapes for the exam.

Since Colorado administers the National Council of Engineering Examiners (NCEE) examination which will be used by all 50 states and four jurisdictions by 1984, this refresher course is applicable to EIT exams given nationwide. According to Capt. Stanley P. Rader, course director with the depart of CE at the academy, "The advent of the nationally standardized EIT exam together with an increasing emphasis on professional registration in the Air Force make this series of tapes a very timely and valuable aid to Air Force engineers pursuing registration."

Captain Stanley went on to say that topics covered in the 29-lesson course include a review of mathematics, statics and dynamics, mechanics of materials, fundamentals of electrical engineering, fluid mechanics, thermodynamics and heat transfer, analog computer programming, computer programming and engineering economics.

Instructors include representatives from the Academy's Departments of Mathematical Sciences, Civil Engineering, Engineering Mechanics, Electrical Engineering, Aeronautics, Astronautics and Computer Science. Each lesson will include a review of theory and application of that theory in solving example problems like those given in the exam. "The tapes," he said, "are accompanied by a syllabus which suggests specific homework problems from NCEE's Fundamentals of Engineering Sample Examination booklet. We strongly recommend that people purchase this booklet to use with the tapes."

How does the base junior engineer obtain these valuable tools? This is where AFIT comes in.

Of the 30 tapes at 45 minutes in length each, only a set of five can be requested at one time from AFIT. According to a lesson official at the institute, AFIT separated the tapes into five segments and hopes to process base requests in mid-July. The segments and their titles will be included in the late summer course catalog, according to Capt. Jim Zwick at the Wright-Patterson Civil Engineering School. For further information, contact AFIT/DE, Wright-Patterson AFB, Ohio 45433.

Heads up
Base Energy Conservation Officers...
The Boy Scouts are coming!

by Maj. Jim McEvoy

Heads up to all base energy conservation officers, the Boy Scouts of America are coming — to you!

A new energy conservation program for Scouts and the Air Force alike will be starting this summer. The joint venture between the Boy Scouts of America and the U.S. Air Force will sport the possibilities of troops and Scouts earning patches, ribbons, certificates, and the Energy Merit Badge, and the Air Force having increased energy awareness and saved energy.

Educating and involving our consumers in energy conservation is the main thrust of energy awareness programs, and an aware consumer with a positive energy attitude is the ultimate goal. The Boy Scouts of America/USAF Energy Conservation Program (BSA/USAF), as this program is called, is a program that can achieve these results.

In describing the BSA/USAF program, a short digression on philosophy is in order. The Air Force's goal is to have [illegible] involvement in energy programs, especially in military family housing where occupants are not directly billed for utilities. We have programs on the main part of base to educate and motivate our adult consumers along with newspapers and other media to reach the adults in the housing area; but, just as important, is our need to get our younger consumers involved.

It is difficult to tell a child or young adult that it is all right to waste energy after they have pointed out a wasteful measure. They are also motivated very easily and their enthusiasm for energy conservation becomes contagious in the home. The bottom line, though, which is the best benefit of all, is that if we can educate the children, there will not be an energy attitude problem when they are adults. An energy ethic will be ingrained and the prudent use of energy will be second nature.

The Boy Scouts of America, as an organization, is totally dedicated to energy conservation. They already have national conservation programs and awards, and even have an Energy Merit Badge. There is also at least one Boy Scout troop on each Air Force base in the CONUS. Additionally, many overseas bases also sponsor troops. The vast majority of the Scouts in these Air Force-sponsored troops live in military family housing so any energy saved, via this program, will be registered on Air Force meters; plus, the Scouts receive some fine training and become eligible to earn some energy conservation awards.

The previous paragraph nailed the exact purpose of the program — *Saving Air Force Energy*. But, there is a give and take aspect. In exchange for the Scouts' efforts, the Air Force is offering the Scouts patches, ribbons, and certificates. We would also like to make available to them our base energy conservation officers. We have requested that all [illegible] officers volunteer to conduct this program in conjunction with their base's Boy Scout project officer and Scoutmaster. We have also requested that they volunteer to be Energy Merit Badge counselors and establish a one-on-one relationship with the Scouts. The extent of their involvement will make or break the program.

The mechanics of the program are simple. Every AF[illegible] troop is eligible for the BSA/USAF Energy Conservation Award. This award is a ribbon which will be displayed on the troop flag staff, and a certificate of accomplishment. To win this award, a troop must do three of the following tasks. All of these tasks are to be coordinated with the base Civil Engineer (BCE), who has been alerted to this program by letter. Since all bases have unique situations, optional tasks may be included. A scoutmaster can request optional tasks if circumstances preclude the accomplishment of one or more of the three requirements. These requirements are:

a. Distribution of fresh furnace filters in military family housing. (BCE coordination, base approval, and publicity are required.)

b. Weatherization of the Scout meeting place. (It is assumed that it is an AF facility and can be accomplished via a self-help work order.)

c. Energy audits of base buildings. (Several buildings to be selected by the BCE will have a simplified energy audit performed with the results being given back to the BCE.)

d. Optional projects may be substituted if a, b, and/or c are not possible. Projects should be devised in such a manner as to make the Scouts feel that they are accomplishing worthwhile tasks.

A troop will be eligible to win this award on an annual basis, and a different ribbon will be awarded each year.

Each Scout is also eligible to win individual awards. Scouts who participate with their troop in the earning of the troop award are then eligible to earn the BSA/USAF Energy Conservation Patch. All they have to do in addition is earn the Energy Merit Badge and discuss the AF energy program with their base energy conservation officer.

The program will be controlled by the Energy Group at the Air Force Engineering and Services Center at Tyndall AFB, Fla., and has a thumbs up from Boy Scouts at the national and council level. All we need now are Scouts, bases, and the support of base energy conservation officers.

The joining together of the Boy Scouts and the Air Force in an energy conservation bond is a natural one. Both organizations will benefit from this program and the entire nation will benefit from the energy savings. Scouts on each base can lead the way and set the example for other base personnel to follow. This is a program that a base can run at no cost but has a tremendous payback in terms of changed attitudes. There may even be a change, for the better, in your meter readings. Try it, you'll like it!

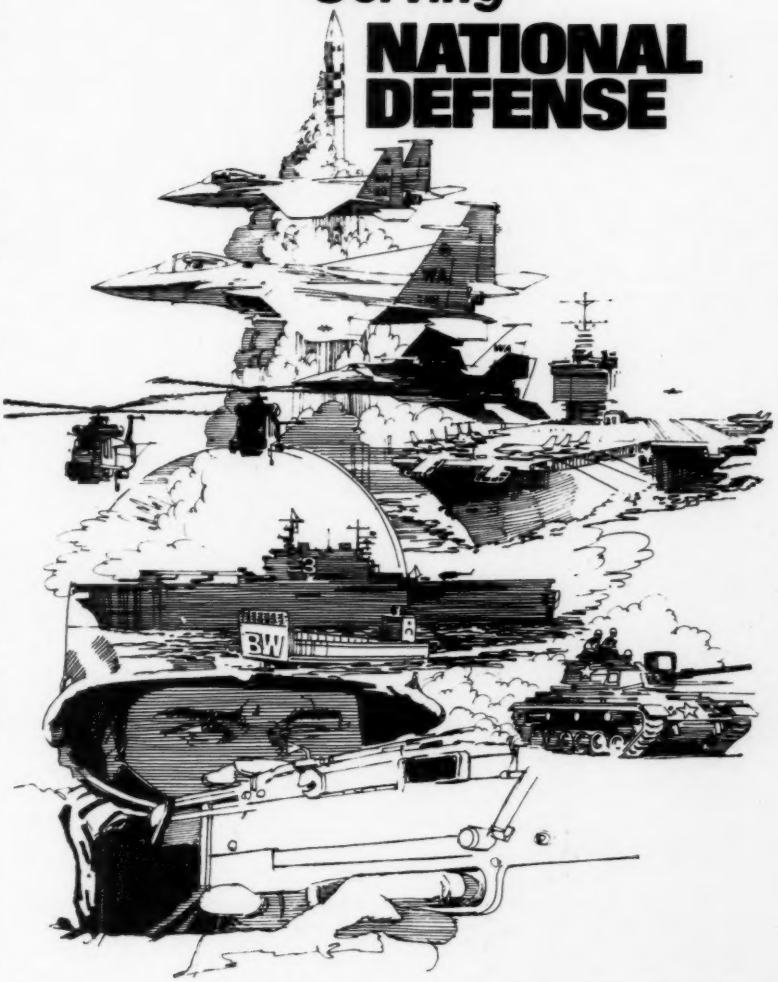
Maj. Jim McEvoy is a staff officer, assigned to the Energy Group, HQ AFESC, Tyndall AFB, Fla. He was previously a C-141 navigator. He earned a bachelor of sciences degree in Electrical Engineering at Grove City College, Grove City, Pa., and a master of sciences degree in Business Administration at Webster College, St. Louis, Mo. He is the first recipient of the Rawlings Energy Conservation Award presented by the Air Force Association.

BOY SCOUTS OF AMERICA
WORKING TOGETHER
TO SAVE ENERGY
UNITED STATES AIR FORCE

DUE TO PATTERNS COVERING PRINT, THIS PAGE DID NOT REPRODUCE WELL. THIS REPRODUCTION IS MADE FROM THE BEST COPY AVAILABLE.

Project Warrior

Polymer Concrete Serving NATIONAL DEFENSE



by Capt. Daniel J. Pierre

The rapid repair of bomb-damaged airfields has become an item of increasing concern throughout the Air Force. The repair of airfield pavements damaged by various enemy weapons must be completed rapidly following an attack in order to launch combat aircraft. In light of new developments in weapons technology (threat) and increased demands in aircraft operations (mission), existing crater repair procedures are inadequate.

The Air Force Engineering and Services Center at Tyndall AFB, Fla., has been investigating new compounds capable of multiple uses in the Triple-R scenario. These uses include the full range of runway repairs necessary to support operations following attack — spalls, small and large craters. It is important to note that the range of environments for such a multi-purpose repair material is extreme.

RRR crater repair requirements are quite unique when compared to other routine pavement repairs. The repair diameter of an exploded crater can stretch up to 58 feet for a 750 pound bomb. Depth can approach 15 feet. Since the primary objective is a speedy repair, crater ejecta are not cleared away. Rather, the ejecta are dozed into the crater with limited subsurface leveling and minimal compaction.

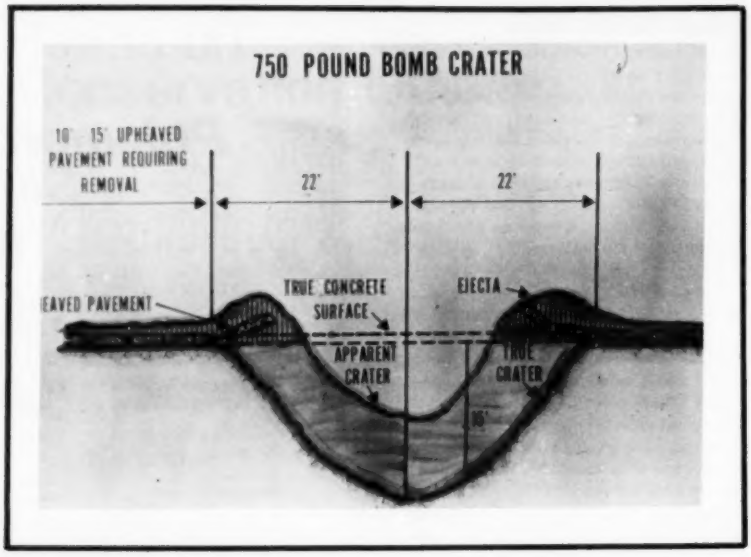
Consequently, low subgrade strengths (CBR 5-7) are typical, especially in areas of high water tables. With this low subgrade strength, a very rigid cap is necessary to support the high aircraft loads. Based on the F-4 aircraft 27,000 lb wheel load, the weak subgrade, and assuming a slab thickness of 12 inches (maximum desirable depth due to placement constraints), the minimum required flexural strength for a potential repair material is 400 psi.

Higher in-place flexural strengths are desirable as they would permit placement of thinner slabs with inherent time savings. The quantity of pavement materials required for one crater repair is also extreme — about 90 cubic yards for a 58-foot crater with a 12-inch thick repair. To further complicate this scenario, this crater slab or structural cap must be placed in 30 minutes under adverse battle conditions and environmental extremes (temperatures ranging from -25 F to 125 F and rainfall rates up to one inch per hour).

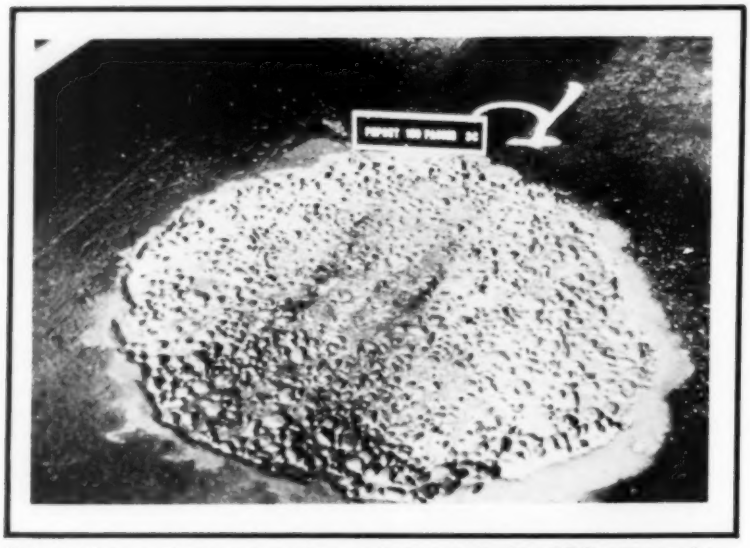
A particularly promising procedure for making fast, flush repairs is to provide a fast-setting cast-in-place structural cap. One class of materials that has shown it can successfully achieve high strengths in short periods of time is polymer concrete (PC). Advanced PC runway crater and scab repair materials capable of setting within ten minutes throughout a temperature range varying from -25 to +125 F do currently exist. However, the strength characteristics of these materials are reduced when any significant levels of moisture are included in the component aggregate.

Since an all-weather, full-range repair capability is essential, additional developmental research is underway to overcome the water incompatibility problem prior to fielding a new material. Based upon an extensive search, identification and initial test and development efforts, the AF has focused advanced development efforts on four PC binder formulations.

The polyurethane PC formulation has been field tested and successfully subjected to F-4 (27,000 lb gear load, 275 psi) and C-141 (141,000 lb gear load, 180 psi) load cart trafficking. Yet, performance of the polyurethane under wet placement conditions is still not satisfactory. The "spongy" PC and associated strength loss resulting from the use of wet aggregate in wet placement conditions is tentatively attributed to the formulation of carbon dioxide bubbles prior to polymerization during the condensation reaction of the polyurethane PC. Formulation modifications are currently under review to minimize this strength loss.



RIGHT: Profile of a bomb crater resulting from an exploded 750 pound bomb.



Polyurethane polymer concrete repair of a scab after 150 passes of an F-4 load cart.

The acrylic material components have been modified to improve their safety and long term strength characteristics. Strength characteristics for the wet acrylic PC are comparable to the dry strengths. Field testing of this acrylic PC under heavy rainfall conditions has proven successful at cold ambient temperatures. However, the high exotherm of this material may pose problems during high ambient temperature placement conditions. Also, the long term stability or shelf-life of this material is an item of concern and is under further evaluation.

Additional AF research includes advanced development of furfuryl alcohol PC and an inorganic candidate material, magnesium poly-phosphate cement. The furfuryl alcohol PC has been successfully field tested under moderate temperature conditions. However, its bond strength to concrete and asphalt is quite low, limiting its applicability for scab repair. The magnesium poly-phosphate is still in the developmental stages with efforts focusing on increasing material strengths and lengthening set times at high temperatures.

Concurrent equipment development efforts to mix and place these advanced materials are also underway. Due to the extremely large quantities of materials required for the structural cap crater repairs, high capacity placement techniques are essential. Techniques under evaluation are percolation into preplaced aggregate and continuous pre-mix production.

This research effort is aimed at meeting a very real Air Force requirement relating directly to operational readiness. The PC performance requirements in concert with the adverse placement requirements pose some unique development problems pushing the state-of-the-art in PC technology.

Capt. Daniel J. Pierre is a 1973 graduate of the Air Force Academy with a degree in Civil Engineering. He earned the master of sciences degree in Architectural Engineering from the University of Texas and the master of Business Administration from Rensselaer Polytechnic Institute. He flew KC-135 aircraft with the Strategic Air Command. He is currently assigned at AFESC, where he is responsible for the advanced bomb damage repair system development program and the foreign object damage assessment program.

Redundant alternate launch and recovery surfaces

Project Warrior

by Capt. Henry F. (Hank) Kelly

The threat to our bases is formidable and projected to increase in the future. The enemy can seriously impair the use of our airfields through concentrated massive air attacks. Failure to recover our airfields after an attack would prevent air combat operations and seriously jeopardize the outcome of a conflict. In both the Falklands and Lebanon, the attacks against Stanley Runway and the Beirut International Airfield illustrate the high military priority of these targets. In a major conflict, the significance of the airfield will be even greater.

Damaged primary runways and taxiways may take hours, maybe days, to repair. Consequently, alternate launch and recovery surfaces (ALRS) will be essential. These surfaces will be preconstructed so they are available and ready for use within one hour after the attack to allow launch and recovery of at least the initial combat aircraft sorties.

Three concepts are being considered to provide this capability:

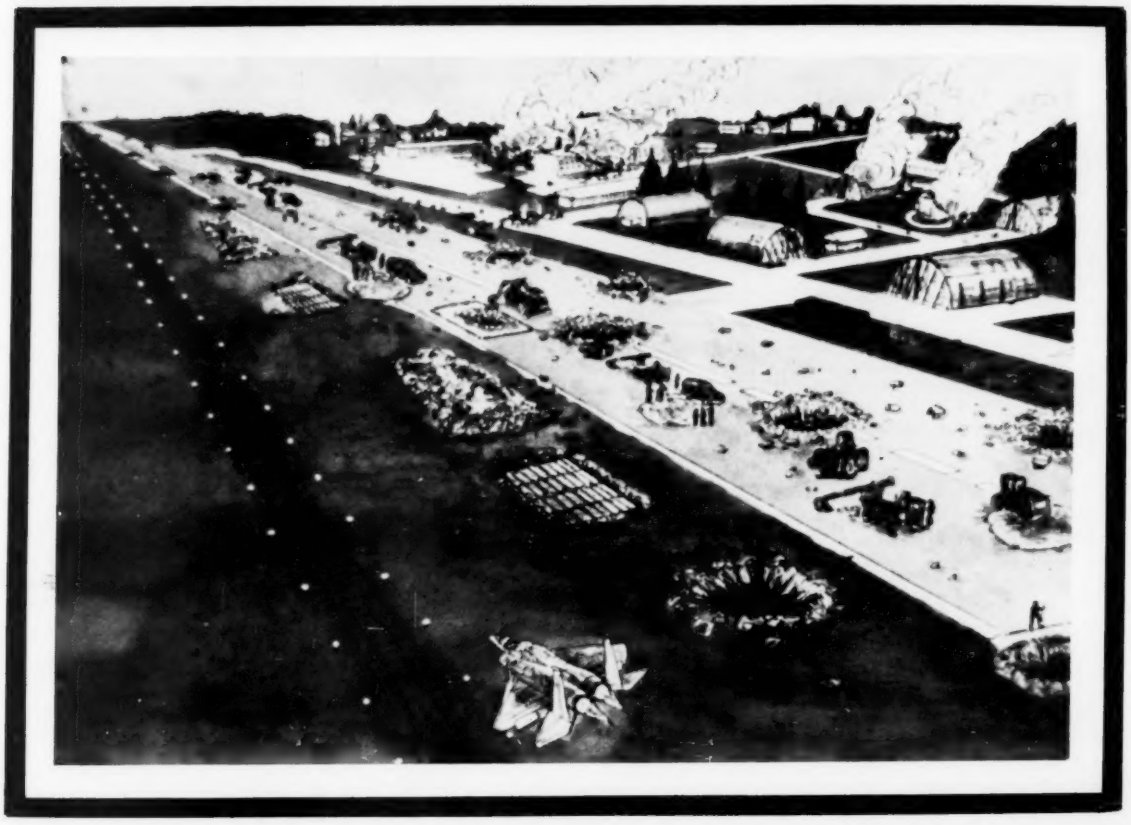
(1) Increased surface redundancy to improve the probability of having an undamaged emergency runway.

(2) Damage resistant pavements, and

(3) ***Instant*** runways which could be established after an attack.

Of these concepts, increased surface redundancy has the most promise, and is the subject of this article; the other concepts are not as fully developed. A sufficient amount of preconstructed surface will be required to insure an undamaged minimum operating strip will be available. Feasibility of this approach is dependent upon developing a pavement system that is low

ALRS concept is to use reduncant surfaces following an attack until primary runway is repaired.



cost to install and very low cost to maintain. This article will describe research being conducted to develop this low-cost pavement system. This research is part of the USAF Rapid Runway Repair (RRR) program, conducted by the Air Force Engineering and Services Center at Tyndall AFB, Fla. The center is accomplishing this work with help from universities, research institutions, and other DOD laboratories.

The initial research effort identified 49 potential concepts through literature search, brainstorming, and consultation with established experts. The list is comprehensive, and includes concepts that border on science fiction. Each concept was evaluated for feasibility and cost.

The more promising concepts identified were steel fiber reinforced concrete, lean (low cement content) concrete, reinforced soil, compacted natural soil, and innovative uses of conventional pavement material. Tests conducted on steel fiber reinforced concrete and lean concrete indicated that they are structurally adequate; however, costs appear to be too high to compete with other systems. Only exploratory development has been accomplished on reinforced soil (using geogrids and geotextiles), so no conclusions have been developed so far. Previous research has shown that compacted natural soil can withstand a limited number of aircraft operations with acceptable rutting. However, since natural soil would normally be too soft to use when wet, this concept appears to be infeasible as an all weather solution. As a result, innovative use of more conventional pavement materials appears to have the most promise. Therefore, the remainder of this article will concentrate on research and development in this area.

There are three main thrusts in developing these inexpensive pavement designs. First of these is using bound material (i.e., chemically stabilized soil) as a pavement system base. Another is using unbound material as a pavement system base. The final is developing a low-cost wearing surface.

Present methods for designing pavements with stabilized soil layers are generally considered conservative, especially for use as an ALRS. The tri-service flexible airfield pavement design method is accomplished by first designing a conventional unbound flexible pavement and then substituting stabilized material for unbound material using equivalency factors. This method does not take into consideration the strength of the material, and is based upon limiting vertical strain to relatively small values to eliminate rutting. The ***Portland Cement Association*** method, which is based upon Westergaard's Equation, predicts initial cracking, but not post cracking behavior. A study is being conducted to produce a design that reduces conservatism by taking into account material strength and incorporating factors to account for post cracking behavior of the pavement. This will be accomplished by adjusting available analytical models to match empirically derived data.

Aircraft testing on compacted natural soil at McClellan AFB.

Testing of stabilized soil pavement sections, 15 feet x 30 feet, was conducted with an F-4 load cart (i.e., 27,000 lb single wheel load and 265 psi contact pressure), by repeatedly towing it over the sections to simulate aircraft trafficking. Controlled variables were stabilized layer thickness and strength. Sections consisting of an inverted design were also investigated. Inverted designs add an untreated granular layer between stabilized base and asphaltic surface to minimize and delay reflective cracking. Shrinkage cracks naturally occur in cement-stabilized bases soon after construction, and normally reflect through the asphaltic surface. Generally these cracks are small, and rarely cause failure, but may require increased maintenance.

The test results agreed with analytical findings that thickness of the stabilized layers is more important than the strengths of the materials (over a certain minimum strength). An in-depth analysis of the test data is being performed to determine the mechanism of failure, in order to validate and modify the analytically developed design procedure.

Test results also indicate that a wearing surface, such as asphalt concrete, may not be required on stabilized soil in order to successfully serve as an ALRS. Locked wheel skids with the F-4 load cart demonstrated that the stabilized soil has adequate friction even when wet. The surface showed little distress under this rather severe test, and the friction was so great the tire ripped. As a result of traffic, some dusting of the surface occurred, but the loss of fines was not significant. Although unsurfaced stabilized soil will be subjected to greater load induced stress (because of less cover) and more freeze-thaw cycles (with associated loss of strength), making the stabilized soil layer(s) stronger (i.e., increasing the stabilizer content or improving the quality of the soil to be stabilized) can alleviate these problems. Thus there is a tradeoff in costs. Further tests will be conducted to confirm that unsurfaced stabilized soil can meet ALRS criteria.

Capt. Henry F. Kelly is with the Engineering and Services Center, Tyndall AFB, Florida. He received his bachelor of science degree in Civil Engineering from the Air Force Academy, and the master of sciences degree in Geotechnical Engineering from the University of Arizona. He is a member of SAME and is presently in the process of becoming a registered Professional Engineer in the state of Colorado. Prior to his current assignment he served at Ankara Air Station in Turkey under TUSLOG.

Durability of stabilized soil samples will accurately be determined in accelerated laboratory freeze-thaw testing. An environmental testing unit will simulate freeze-thaw action (cooling rate, freezing temperature, duration of freezing, warming rate, thawing temperature, duration of thawing, and number of freeze-thaw cycles) the pavement will actually experience during its service life. These freeze-thaw parameters will be generated by multilayered pavement heat-transfer model using actual 20-year climatic data recorded at a typical U.S. base in Germany.

Another thrust of the ALRS Program is a study on how to reduce cost associated with unbound base and subbase pavement layers. The tri-service design manual for flexible airfield pavement requires the base to consist of high quality material, with a California Bearing Ratio of at least 80. For a pavement that will only be exposed to a limited number of passes, this requirement may be overly conservative. If naturally occurring material could be used, such as bank run gravel rather than graded crushed stone, construction costs could be reduced. Laboratory tests will be conducted to determine the feasibility of using lower quality material. If the results are promising, field tests will be performed to validate this concept. The recently revised Air Force/Army frost design manual is a trend toward using lower quality materials. Formerly, pavement layers exposed to frost had to consist of nonfrost-susceptible material. The new manual (still in draft) allows the bottom 50 percent of the calculated base thickness to consist of slightly frost susceptible material.

Tradeoff studies will show the cost (construction and 20-year life cycle) effect when the ALRS design is adjusted to permit more or less traffic coverages. For example, a design for 200 aircraft passes during worst condition (i.e., subgrade thaw weakening), may allow more than 10,000 passes in late summer. Conversely, design for 200 passes during summer would permit less than 20 passes during frost-melting periods. A careful analysis of the risks and performance may, therefore, allow a significant reduction in costs.

The third area where costs may be reduced is in the wearing surface. A study is ongoing to determine the thinnest asphalt wearing surface that can withstand ALRS loading criteria. The tri-service design manual specifies a minimum of three inches. Sections have been tested with a double bituminous surface treatment and with as little as one-inch thickness of hot-mix asphalt concrete surface course. These tests revealed a probability that thinner surfaces may be acceptable to meet ALRS criteria. To evaluate long-term environmental degradation, F-4 load cart trafficking was applied to existing thin asphaltic pavements that have received little or no previous traffic (e.g., shoulders and overruns of runways, taxiways, or pavements) at Wright-Patterson AFB, Ohio, and Whiteman AFB, Mo. These airfields were selected because the number of freezing-degree days is similar to that of Germany and Korea. The data is still being analyzed, but the tentative conclusion is the same – a thinner asphalt concrete surface may be acceptable for ALRS use.

While all asphalt tends to harden and crack with age, asphalt that has no traffic applied to it for long periods of time appears to prematurely age. Although this is a well known phenomenon, very little research has been done on premature aging of asphalt. The study of thin asphalt will also determine the optimum asphalt mix design to minimize this problem. Preliminary indications are that use of softer asphalt in a gap-graded aggregate mix with a high asphalt content and few voids, may reduce the problem. Laboratory and field tests will hopefully confirm this.

Once it is determined that thin asphaltic pavements are feasible, life-cycle cost analysis should reveal if it is economical. This will be accomplished by developing a predictive model for estimating environmental damage and maintenance required over a 20-year design life to keep an ALRS serviceable. For example, a one-inch thick surface may be less expensive to construct, but more maintenance will be required and may drive the life-cycle costs higher than for a thicker surface.

Validation of the most promising concepts will be accomplished by conducting actual aircraft testing on test sections, and later on a full-scale ALRS. This testing is necessary to evaluate the effects of braking and turning loads, jet blast, and tail hook engagements.

The AFESC goal is to develop a surface that will cost about 30 percent of the cost of a conventional runway, and would provide a very high probability that aircraft could be launched and recovered within one hour after attack.

F-4 load cart is towed behind a truck to simulate aircraft trafficking.

Military people...a vital asset.

by Lt. Col. Robert J. O'Such

A White House Private Sector Survey Team recently visited McGuire to review our management of real properties. During the constructive conversation, one of the staff representatives commented that some of the jobs associated with property management were not classic ***soldier's jobs.*** The idea conveyed, obviously, a desire to examine possibilities for "civilianizing" or contracting out such positions.

Our explanation offered an alternative view. Many positions at McGuire, as well as throughout the Air Force, are not traditionally combatant. They are the ***tail*** part of the ***(tooth to tail)*** ratio planners use in structuring forces. Most of these military positions, however, fulfill a critical surge function when our forces are mobilized for national defense.

Military members of the Civil Engineering and Services Squadrons, for example, are trained as Prime BEEF and Prime RIBS mobility resources to deploy in direct support of combat operations. Other members form augmentation teams to supplement warskills, which are critically needed. In fact, every military member is a vital national defense asset. That's why we train so hard to be prepared for our wartime mission.

I'd like to share with you what I've told the professional men and women of the Services Squadron regarding the role they play as our country's warriors.

- The Air Force's role is to preserve the freedom of all Americans, and our job is to make sure that McGuire is constantly prepared to provide care and feeding for those directly involved in "soldiering."
- If necessary, we will fight to protect our national interests. That prospect of armed conflict is so serious that we tend to believe it's too remote and really can't happen. Recent wars and conflicts shock us back to reality!
- Reflect on your importance in sustaining our readiness, and therefore your obligation to be prepared.
- Services people are critical mobility assets – no army can fight properly without food and shelter, and we will assure that our troops get them, anywhere and anytime!
- Services people will keep the homebase going – if we go to war, McGuire will bristle with activity and people – we'll make sure they are properly nourished and rested to do their jobs.
- In a disaster, Services people help in the most sensitive and dedicated aspects of caring for our fatalities. No other country's Air Force is prepared to do as well.
- Preparedness, that's the key word! Services people assure that everyone at McGuire receives a quality of life that enable them to perform and train as defenders of our democracy. You do this 24 hours a day, seven days a week, and 365 days a year.
- Survival, another vital role. Services people will find the way to distribute equitable rations and shelter occupants to keep our force going in even the worst war environment.

Today, we are reading and hearing about ***Project Warrior,*** an Air Force program designed to remind us of our ultimate responsibilities as members of the United States Air Force. In a support oriented organization such as Services, we could believe that ***Project Warrior*** refers to combatants – the troops we fly strategically to fight for our country. Don't. You are what Project Warrior is about. How you do your job now reflects on how we all will do in meeting our stiffest challenge when called upon.

Lt. Col. Robert J. O'Such is the services squadron commander, McGuire AFB, N.J. He was USAF Senior Services Officer of the Year. He is a graduate of Duquesne University with a bachelor of arts degree in Journalism and holds the master of arts from the University of Denver in Mass Communications. A C-141 command pilot, he also served in the Public Affairs career area at HQ AFLC and as wing safety officer at McGuire.

Project Warrior

Testing Our Ability to Survive Attack.

by CDR James W. Carl, CEC, USN, PE, and Walter C. Buchholtz, PE

The capability of our operational forces to survive an initial attack and launch an immediate counter strike is a vital concern to our field commanders. The Air Force Engineering and Services Center (AFESC) performs a significant role in this regard by developing the protective construction technology essential to survival. While AFESC is well known for advancing our capability in post-attack launch and recovery of aircraft, it has also been widely involved with the development of physical protection measures for airbase facilities vital to sortie generation. Test programs concerning two key survivability issues were conducted by the Airbase Survivability Branch of the Engineering and Services Laboratory (ESL) last summer.

The first test program was to determine the survivability and repairability of a fuel pipeline distribution system proposed for the semi-hardened aircraft shelter, in-shelter refueling program. The program has been receiving significant interest throughout the NATO and U.S. Air Force Europe (USAFE) communities in recent months. The second test program was to determine if the reinforcement steel content currently specified by the NATO Semihardened Design Criteria for reinforced concrete can be reduced. The current criteria is based on analytical procedures developed in the sixties. Each test program is discussed in detail below. AFESC was assisted on both test programs by the Civil Engineering Research Division of the Air Force Weapons Laboratory (AFWL) which contributed immeasurably to the success of these efforts.

Fuel Pipeline Survivability and Repairability Test

In April 1982, USAFE approached ESL concerning the Lab's capability to conduct a fuel pipeline test by late summer. The short time frame was necessary due to NATO programming decision points. ESL agreed to the time constraints and scheduled the tests in conjunction with the semi-hardened wall tests.

The fuel pipeline test consisted of one explosive event with a domestic bomb serving as the explosive charge. Four pressurized 8-inch stainless steel pipelines were placed at varying distances from the bomb in order to examine the pipe's survivability. The 110-foot long pipelines were buried three feet below the surface and cast in massive concrete deadmen at each end to simulate a continuous pipeline. A rosette of eight strain gauges was placed on each of the four pipeline sections at the point closest to the bomb. Other instrumentation included soil stress gauges, accelerometers and high-speed cameras. Extensive data were collected during the explosive event.

The center of gravity of the bomb was buried approximately nine feet to obtain the maximum crater. Only the two pipelines nearest the bomb were exposed upon detonation. The pipeline closest to the bomb was severely deformed but intact. It was apparent that the steel had been stressed into the plastic range. Fuel flow was estimated to have been restricted approx-

imately 35 percent based on the deformation. Pre-test estimates had predicted that the pipeline closest to the bomb would most likely be ruptured. The lack of any puncture in the pipe was a significant finding. The next closest pipeline to the bomb had been constructed using a repair coupling. It was badly bent and had slipped out of the coupling. It also appeared to have been stressed into the plastic range. Neither of the other two pipelines received any damage.

Several problems were encountered during the repairability phase of the test and it was just for this purpose that the test was conducted. The three primary concerns that evolved from the test were: the pipe can be easily deformed during cutting; the repair coupling tested has a small working tolerance; and a more rugged hacksaw is required for expedient repair work. All concerns are considered minor and easily rectified.

In short, the fuel pipeline test provided considerable data for our field planners. The NATO and USAFE representatives were extremely pleased with the results. The most significant finding from the test is that stainless steel pipe is much more durable than anticipated. In fact, it is doubtful that expedient repairs would be necessary based on the high degree of survivability demonstrated. Data collected during the test are presently being analyzed and reduced into a technical report. The test has also received considerable interest throughout the R&D community since it is the first known determination of how buried stainless steel pipe will respond under extreme loading conditions.

Semihardened Wall Test Series

The semihardened wall tests were also conducted at the request of HQ USAFE. Current design criteria used for physical protection construction are antiquated and known to produce overly conservative reinforcement designs. Headquarters USAFE requested that AFESC develop an improved design criteria which is most cost effective but will still satisfy NATO weapons threat criteria. The only means to adequately evaluate the accuracy of any revised analytical techniques is through actual explosive testing.

Although difficult to imagine, little information is available for either the airblast loadings on a wall from a large bomb detonated at very close range or the structural response of reinforced concrete to such load conditions. Therefore, a two-year program was defined to develop the revised design criteria. The first year's test in August and September 1982 would be devoted to bounding the design parameters, with the second year's tests directed at specific design solutions. The services of the Structural Mechanics Division, U.S. Army Engineer Waterways Experiment Station (WES), were acquired because of their extensive background in modeling both reinforced concrete and weapons effects. After considerable discussion between USAFE, the Air Force Weapons Laboratory (AFWL), WES and AFESC, six reinforcing steel designs were identified for the first year's test program. Four walls were designed with stirrup shear reinforcement and the other two walls were designed with dowel shear reinforcement. The vertical reinforcement for the first four walls varied from two percent to 0.25 percent steel (by volume each face). The two walls using dowels contained 0.5 and 0.25 percent vertical steel (by volume each face), respectively.

Determining the effects of an explosion on buried stainless POC line.

Three, one-half scale model open-end structures were constructed for the test specimen. They were 13 feet long, 7.5 feet square and had 12.25-inch-thick walls. Only the side walls of each box structure were tested. The top and bottom of each test article were designed to represent the facility roof and floor, respectively. The box-structure configuration also enabled the testing of each wall's post-test capability to provide protection against chemical-biological attack (gas-tightness integrity).

The test articles were bolted to a massive support structure in order to minimize rigid body translation. To record the test environment and structural response, over 40 channels of data were collected during each explosive event. Data collected included air blast pressure loadings on the specimen and free-field, instructure acceleration, relative displacement of the walls versus time, and the reinforcement steel strain. In addition, high-speed cameras were used to record both the internal and external wall response.

Analysis of the extensive data collected during this first year of tests has just commenced. However, preliminary indications are that the current design criteria used for semihardened wall reinforcement steel can be reduced considerably and still maintain an acceptable gas-tight integrity. The wall designs using stirrup shear reinforcement far outperformed those using dowels. The stirrups appeared to have assisted in countering the flexural loading on the walls as well as the large direct shear forces at the wall base. The dowels provided no resistance against flexural loads that resulted in considerable flexural cracking throughout the wall. This resulted in neither wall constructed with dowels being able to maintain a post-test gas-tightness integrity.

Although the designs for testing in 1983 have not been defined, several design parameters will be given considerable attention:

- The vertical steel in the wall must be continued into the roof to reduce flexural cracking at the wall/roof interface.
- A spall plate is required at the base of the wall. Although spalling appeared to be minimal, it does present a definite hazard to any object in close proximity.
- The stirrup shear reinforcement enhances the flexural loading capacity of the wall as well as counteracting the large direct shear forces at the base of the wall. Reflected pressures in excess of 15,000 psi appear to occur at the toe of the wall.
- The vertical steel on the interior face of the wall is much more important structurally than the exterior steel. It appears that

Expedient repair of stainless steel POC lines after explosion.

possibly half as much steel is required for the exterior face.

Based on the knowledge gained this year, the 1983 tests should significantly improve the cost-effectiveness of providing physical protection for our critical air base assets. It is anticipated that they will also lead to additional understanding of the ballistic environment of the weapon threat and dynamic response of the structural system. Technological advancements in these two areas will lead to even greater survivability improvements in the future.

CDR James W. Carl (USN) served as an exchange officer with the Engineering and Services Center (HQ AFESC/RDC) before his current assignment. He also served with the Navy in civil engineering assignments to Guam, Okinawa, Thailand and Hawaii. He earned his bachelor's degree in Engineering from the University of California. He is a registered Professional Engineer in the state of Hawaii. He is a past president of the Panama City Post of the Society of American Military Engineers and a past treasurer of the Guam post.

Walter C. Buchholtz is assigned to the Engineering and Services Center, Tyndall AFB, Fla., where he is a structural research engineer. He has also served as project engineer on Third Generation Aircraft Shelters (HQ USAFE/DEEE) and as an Air Staff structural engineer at HQ USAF/LEEES. A graduate of Drexel University, he is a registered Professional Engineer in Virginia and in Florida.

Directorate of Engineering and Services

Current Emphasis

a brief commentary on significant developments

THE FACILITY ENERGY PLAN — also known as the 10-year energy plan, is generated annually from updates from MAJCOM energy officers. The plan is used in the POM process and in forecasting energy goal progress. Our FY85 goal is a 20 percent reduction versus FY75. This year's plan projects a 20.4 percent reduction by FY85. This small margin is not enough to insure goal attainment and we must continue to push energy conservation. (AFESC/DEB, Maj. McEvoy, AUTOVON 970-6454)

AIR FORCE NOW FOCUS ON ENERGY — The first in a series of energy conservation spots was included in the June Air Force Now. The subject was solar energy. Purpose of the series is to show positive aspects of our program and that even more can be done. Accent is on the positive. (AFESC/DEB, Maj. McEvoy, AUTOVON 970-6454)

ENGINEERING AND SERVICES STRATEGIC PLAN — An engineering and services strategic plan has been developed to articulate E&S goals, objectives and strategies as a management guide for all levels of E&S activities. The senior leadership of the E&S community reviewed and validated the plan during the initial meeting of the Engineering and Services Requirements Board (ESRB) March 16-18, hosted by the Air Force Engineering and Services Center, Tyndall AFB, Fla. Copies of the plan have been provided to MAJCOMs and other E&S organizations for further distribution. (AFESC/PQR, Maj. Murphy, AUTOVON 970-6447)

DEFENSE ENERGY INFORMATION SYSTEM (DEIS) — The DEIS-II facility energy report recently changed from a monitoring tool to more of a management tool. A new, expanded format was implemented May 28 via letters from AFESC/DEB dated Oct. 14, 1982, and March 24. The new report has several significant changes. Military Family Housing (MFH) data is reported separately from base (non-MFH) data, including process and new building consumption data. Renewable consumption is reported along with weather data and building data (number and square feet). The FY75 baseline had to be reestablished due to separating of MFH and base consumption and building data. FY83 consumption and building data in the old format was also converted. All FY83 data is now in the revised format. The revised DEIS-II capability also features access to the DOD data base, via existing remote terminals at the MAJCOM level. This will provide data checking and report writing capability. It shouldn't be available for use until the end of FY83. Further guidance in this area is forthcoming. The revised DEIS-II, while requiring more data input, will ultimately enable all levels to track consumption and progress on distinct energy goals using computer links that will not only save time but improve accuracy. (AFESC/DEB, Maj. Odom, AUTOVON 970-6462)

INFORMATION MANAGEMENT SYSTEMS — The new IMS Office at the Air Force Engineering and Management Center, Tyndall AFB, Fla., is now fully operational. The staff includes Col. Aldinger, Maj. Hamill, Capt. Combs, Capt. Cox, Capt. Spillers, 1Lt Clayton, and MSgt Dapelo. Maj. Golondzinier has departed for a tour in Iceland. All members of the office can be reached at AUTOVON 970-6455 and -6390.

Airfield Pavements... A Valuable Resource.

by K. Stuart Millard

Webster defines resource as something that lies ready for use. Our airfield pavements are indeed a resource if properly maintained; otherwise, a hazard for aircraft and crew which must use them.

Since the Air Force is built around the concept of a flying, capable, combat-ready force with tremendous speed, striking power and range, the launch and recovery surfaces are critical to all levels of mission capability. Whether we are engaged in training activities, routine peacetime operations, airlift and resupply, or strategic, tactical and defensive launch and recovery, the condition of the operating surfaces has direct mission impact. Further, that which is in poor repair or condition today will surely deteriorate and degrade under wartime operational requirements at a far faster rate than the newer and better maintained surfaces.

The Air Force maintains roughly 210 million square yards of airfield pavements which is equivalent in area to 41,800 football fields or a sidewalk 3 feet wide extending around the equatorial circumference of the earth 4.8 times. To maintain and repair those airfield pavements, the Air Force spends approximately $35 million annually. Beyond that current yearly outlay of funds the Air Force presently has programmed for fiscal years 84-89 approximately 1,050 projects for pavement maintenance and repair at a cost of over $534 million. This means in the coming years approximately 2.5 times our present spending rate will be required to maintain our pavements.

Over 90 percent of our airfield pavements have exceeded their design life and most are well over 20 years in age. Deterioration of these pavements has been increasing at a progressively rapid rate. In the past, maintenance of these pavements was limited to spot repairs or by overlaying with a tar or asphaltic concrete pavement. This work was accomplished as required with available repair funds. As funds became limited more of this work, which was becoming more extensive as the pavement aged, was deferred. Today, the best maintenance or rehabilitation procedure of the aging pavements is rarely obvious, and funding restraints require a priority system for repair projects. For these reasons pavement management has become increasingly important. And an adequate inventory of all pavement data is necessary for good pavement management. Pavement data should include measurements for and evaluation of structural adequacy, skid resistance, and surface condition.

There are numerous ways to properly inventory and assess the condition of operating surfaces. Most of these have evolved from the same basic requirement, establishing a quantitative and qualitative baseline through which to prioritize and program needed improvements, repairs and renewals. The Air Force Engineering and Services Center's Operations and Maintenance directorate has been at the leading edge of the technological and qualitative programs which have been implemented with one primary goal in mind – assisting the major commands and Headquarters Air Force in an effort to aggressively attack the problems of wear, breakage and age.

Structural adequacy can be determined only if a pavement's load-carrying capacity is known. A determination of load-carrying capacity requires field and laboratory testing of pavement samples for strength and physical properties. This data is input for a computer program which calculates allowable gross loads (AGLs) for the pavement by various aircraft groups. Conducting structural evaluations in the past meant all samples were taken by destructive methods, that is, by physically removing pavement cores and bulk soil samples from test pits in the pavement. These procedures result in a shutdown of operation on that pavement facility. Although in some instances destructive testing is the only way to provide the needed data, a method to rapidly assess a pavement's strength with some type of non-destructive equipment could provide needed answers. Our goal for a non-destructive testing capability is equipment simple to operate, reliable and air transportable. Non-destructive equipment meeting most of our requirements is now being used alongside destructive testing to determine its reliability.

Stuart Millard is a pavements consultant with AFESC/DEMP. He was previously a pavements engineer with HQ AFRES, Robins AFB, Ga. He earned his bachelor of sciences degree in Civil Engineering at North Carolina State University. He has completed extensive graduate work in pavements and soils at AFIT and the University of Wisconsin.

Skid Resistance

Skid resistance is a measurement of the potential traction between a pavement's surface and aircraft tires. Field tests are conducted to evaluate skid resistance of a runway pavement and hydroplaning characteristics. This test program consists of measurements of surfaces under both dry and standardized artificially wet conditions. Additionally, tranverse slope measurements are obtained for areas on each side of the runway centerline to evaluate the surface drainage characteristics. Upon completion, a determination is made as to corrective action necessary to improve the runway traction performance, or whether to recommend that wet weather advisories be issued to flight crews using the airfield.

PCI

Another important part of good pavement inventory data is obtained by an airfield pavement condition survey, a visual inspection of the pavement surfaces measuring pavement distresses on the surface. The survey is performed by using the pavement condition index (PCI) method of measurement contained in AFR 93-5. The PCI is a numerical indicator that reflects the structural integrity and surface operational condition of the pavement. It is calculated based on type, severity, and density of distresses. The PCI not only indicates the present condition of the pavement, but also provides a rational basis for:

(1) Determining maintenance and repair needs, and priorities;

(2) Determining rate of pavement deterioration between surveys;

(3) Comparing the condition and performance of pavements at various installations; and

(4) Justification for major repair projects and for requesting structural evaluations.

PMMS

To help base and command engineers better manage their pavements the Air Force has been actively engaged in the development of a Pavement Maintenance and Management System (PMMS) since the early 1970s through contracts with the U.S. Army Construction Engineering Research Laboratory (CERL).

The Pavement Condition Index or PCI

was developed initially as a basis for PMMS. Following Air Force-wide implementation of the PCI method of measurement, CERL prepared guidelines for maintenance and repair (M&R) alternatives based upon results of PCI surveys. Procedures for applying economic, mission and policy considerations to maintenance alternatives and optimum selection of these alternatives were included in that study. After maintenance strategies were validated through several field applications, they also were distributed Air Force-wide.

CERL next developed analytical methods of predicting pavement condition (PCI vs time) as a consequence of undertaking M&R alternatives. Consequence models required a considerable amount of data and many computations, especially if many pavement sections were analyzed concurrently. It became necessary to develop a computer-aided pavement management information system.

APMS and PAVER

The Airfield Pavement Management System (APMS) was developed at CERL to fulfill this need. In April 1982, implementation of APMS at Air Force installations became a possibility with use to be decided by major commands. Since then APMS has evolved into PAVER (which includes roads and parking lots). PAVER's use is universal within the pavement maintenance field, and is already being used by the Army, Navy, and a number of municipalities. Air Force experience with PAVER to date has been at McClellan AFB, Calif., and at AFLC, TAC, and ATC headquarters. PAVER provides a rapid means to store and retrieve inventory information about a pavement network. PAVER reports provide the base pavements engineer with a fast, accurate and rational method to help make and support most cost effective maintenance and repair decisions.

A PIP

Another integral part of the total Air Force pavement maintenance management program was the development of the airfield Pavement Improvement Plan (PIP). The PIP is a long range improvements plan identifying contract M&R airfield pavement project requirements. The PIP was initiated back in 1979 by Maj. Gen. William D. Gilbert because of his concern over the aging and deteriorating condition of airfield pavements Air Force-wide. The PIP was first used during the development of the FY82-86 Program Objective Memorandum (POM) as a separate program decision package to obtain funding specifically aimed at improving airfield pavements worldwide. Resource requirements were identified and prioritized by AFESC based on individual major command inputs. AFESC began working the program for preparation of the FY82 Budget Estimate Submission. Since then PIP has served as a valuable management tool. It can be used to:

(1) Program airfield projects sufficiently ahead of time to determine the feasibility and preferred work schedule to minimize interference to the flying mission and exercises;

(2) Enable engineers to better program work to be accomplished on the same airfield facilities; and,

(3) Enable tracking of pavement projects from year to year.

Good pavement management, management systems and timely acquisition of funds are essential to sustaining airfield pavements as a resource, but recommendations pertaining to repair materials and techniques are equally important. Pavement consultants at AFESC and MAJCOMS continually monitor public and private efforts which may be applicable to Air Force pavements. Areas of high interest include recycling, joint sealing, surface sealers, patching or inlay materials, and pavement marking materials.

Recycling has proven to be an economical and environmentally acceptable alternative for restoring our airfield pavements. Recycling can:

(1) Help to reduce construction costs;

(2) Conserve natural resources;

(3) Reduce the amount of energy required to maintain and rehabilitate pavements;

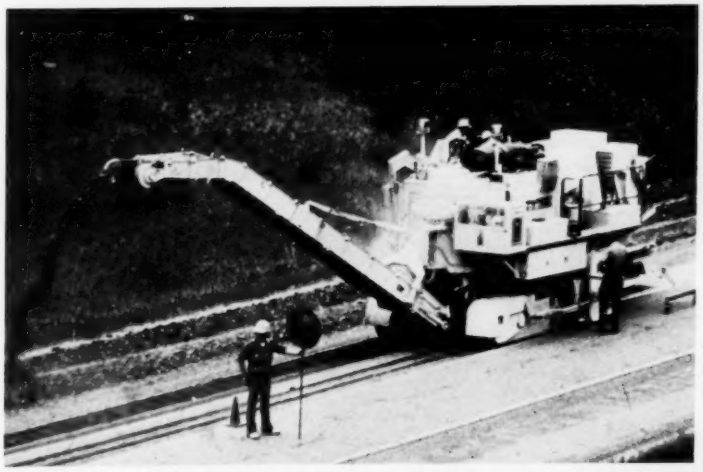
(4) Help preserve the environment; and,

(5) Preserve existing pavement geometrics.

Although recycling of asphaltic concrete has been more popular than that of Portland Cement concrete (PCC), pavement consultants are working on methods to make PCC recycling more appealing in the future. Our pavement consultants are pursuing the necessary steps to determine if recycling of porous friction course (PFC) is indeed a viable alternative.

In summary, the condition of our airfield pavements relates directly to the ability of the Air Force to accomplish its mission. In a wartime environment the launch and recovery of aircraft will depend upon the continuous availability of a quality airfield. Airfield pavement must be ready, available and compatible with the structural design and load characteristics of the aircraft it will be required to support. We must know our pavements, and we must know the best techniques and materials to make those pavements better. We must continue to obtain funds and make the most of those funds with new materials and techniques, as our efforts are essential in keeping our airfield pavements a useful and vital resource.

Project Warrior



A typical cold milling machine used in removing all or part of pavement by grinding.

Project Silver Flag Alpha

by 2nd Lt. Thomas L. Hansen

Silver Flag Alpha is the combination of two separate projects – constructing an entire exercise area, and additionally building the Tactical Air Command's Combat Arms Range. The exercise is held at Nellis AFB, Nev., annually and includes classroom work, barracks, messing facilities, an administration building and shower facilities.

First About the Exercise

The Combat Arms Complex is used simultaneously to train people in small arms and crew-served weapons. The complex has 13 ranges with training provided primarily to Security Police Air Base Ground Defense forces. Also trained in defensive warfare and small arms are RED HORSE, Prime BEEF, Tactical Air Control and Special Operations teams along with other people with a high potential for possible ground combat.

Every exercise is a "training" experience and Silver Flag is no exception. Trainees are airlifted to Nellis for realistic deployment and tactics training. There they remain under field conditions for 15 days. During this time they are trained in the use of various Air Force-assigned small arms, defense tactics and maneuvers, combat while wearing chemical warfare gear, helicopter area denial, and target training against hard and soft moving targets and light skinned vehicles. Security police receive some offensive training. They are also taught land navigation, desert survival and camouflage with forward operating line operations.

The trainee begins with firing at easy electrical pop-up and fixed targets. These targets are close to the more complex ones and set at the maximum effective range of each weapon. The Air Force has deemed this type of training essential due to the ever growing threat to the nation's defense. To acquire this training, an area had to be prepared . . . construction had to begin.

The Task

In April 1981 the 820th RED HORSE at Nellis was tasked to build the exercise area and complex. Before construction could begin, several constraints were placed on the project.

ABOVE: First of 11 range towers set in place.
RIGHT: Firing line.

Construction of the bivouac area had to be completed by April 16, 1982, and the overall project completion date could not exceed July 12, 1982. Also, there was to be minimum disturbance to the vegetation and surface contour so that realistic training could be successful.

Planning was completed by the squadron in April 1981. Work and time schedules were revised again and again to meet commitments which meant frequent visits to the site by 820th engineers. Planning documents had to be revised, reviewed and approved by TAC. According to unit sources, this project was the largest ever undertaken by the 820th CES in peacetime.

The unit erected 10 hardback tent facilities with foundations and pads. They built a mechanical room for heating and storing hot water and providing pressurization. They installed a 5,000-gallon underground tank with pumping and alarm systems. A shower unit was constructed along with a leach field to dispose of waste water.

Each facility required electrical lighting and power outlets.

To build the 3.5 miles of all-weather range road, the unit had to dig, haul and place 20,000 cubic yards of soil and install 150 culverts from 18 inches to 60 inches in diameter.

Even more extensive was the range portion of the project. Eleven range towers were fabricated, installed and wired with speaker systems and nightfire lighting controls. One and one-half miles of firing lines had to be bermed. Two hundred miles of control and power cable had to be laid and hooked up. One mile of underground conduit up to four inches in diameter had to be installed. Four miles of trenching had to be dug and backfilled. A 1.5 mile, 7,200-volt, overhead electrical power system had to be erected. The unit had to prefabricate some 900 target pads, barrier walls and target supports weighing up to 1,000 lbs. Some 700 range signs had to be constructed, painted and placed. Electrical field junction boxes had to be fabricated of concrete.

All these tasks and other construction materials had to be transported from Area

II, Nellis AFB to the construction site 50 miles away. A constant truck convoy was used throughout the construction period.

Construction Begins

On Sept. 16, 1981, the unit started construction on the range road. Material lists were reviewed and ordering was begun. More than 600 individual line items with a dollar value exceeding $500,000 had to be ordered and tracked. RED HORSE supply people and the project manager developed the tracking system that would record each item as it came in, dollar amounts, identifying the subportion of the project to which the item belonged, indicating the date it was shipped and showing the date of its installations.

By the end of the first month of construction, the road crew had completed 6,000-feet of road and opened a path to the bivouac area.

During November 1981 another phase took place. A 100-foot square high security storage yard was completed and ready to receive materials. A field office and guard trailer was then moved to the site. From Nov. 12, 1981, to completion of the project on July 12, 1982, the unit kept people on site 24-hours-a-day. Also during that month, the bivouac area was cleared of vegetation, leveled and forms were built for concrete foundations and pads. The 3.5 miles of range road was finished except for single surface road treatment which would not be placed until July 1982.

The entire range was then opened to construction.

The squadron began clearing firing lines on the individual ranges but a major effort was required to correct an existing terrain problem which interferred in the downrange visibility from the firing lines.

December-January, Winter Settles

During the months of December 1981 through January 1982, the 820th completed the bivouac area tents and readied them for canvas. The exterior electricians were able to install 1.5 miles of the high voltage power distribution system poles and crossarms. Subzero chill factors and snow during the winter could not deter the squadron. Hot coffee was the big order of the day and often workers would consume 20 gallons of it in a single shift. Equipment breakdowns, though frequent, were met by the superior efforts of the site mechanic working nights and weekends.

By February 1982, the project began to take shape. In spite of biting cold and constant desert winds, morale was high. As each milestone was met, one could feel the excitement and dedication of the troops. Foundations and the framework were erected to complete the required buildings. Plumbers started work in the mechanical building and on the leach field and shower tent components. Equipment operators placed and backfilled the 5,000-gallon water tank and began the four miles of trenching which would eventually contain the one mile of electrical conduit and 200 miles of electrical cable. The first range towers were placed.

By March 1982 plumbers finished the leach field, shower tent and mechanical building. Equipment operators and electricians continued on the ranges – excavating, placing and backfilling target placements.

In April the squadron's people gained the experience of working while wearing respirators and protective goggles. Desert winds often reached 60 knots or better. Blowing sand limited visibility to 20 meters. Regardless of the conditions, April 16 found the bivouac area completed on schedule.

May was the "Month of the Electrician." Electrical teams nearly completed the range wiring ahead of schedule. The last of the underground conduit was installed, final trench conductors pulled in and, for the most part, hooked up. All the towers were electrically ready and the exterior electricians completed all overhead power distribution lines except for tie-in to commercial power. The range crew built a 625-foot LAW backblast wall and started placing range signs.

Third installation step of a pop-up target.

Summer

By June 1982 the temperatures hovered at 114 degrees Fahrenheit. Tools, equipment and machinery became so hot that when touched they would burn the skin. Thirst was such that during the last months workers went through 100 cases of Gatorade. But much was accomplished. Trenches were backfilled. The speaker system was installed. The road system was ready for single surface road treatment. Everything was tested, adjusted, bumped, flipped and retested.

July 1982 was the beginning of the end. The field office came down. Final backfilling was done. All of the ranges were retested. Equipment was convoyed home and project cleanup began. The single surface road treatment was finished and allowed to cure.

On July 12, 1982, the final inspection was held and the projects (both the exercise area and combat ranges) were accepted by the Nellis base civil engineer.

Specifics

From start to finish, Silver Flag Alpha took 15 months to complete. It took 40,000 man-hours and 8,000 equipment-hours of the 820th CES' resources. Fuel totaling 39,000 gallons and the combined cost of both projects came to $1 million. The job was complete.

Project Warrior

Second Lt. Thomas L. Hansen is a civil engineer assigned to 820 CES/HR, Nellis AFB, Nev. He earned his bachelor of sciences degree in Civil Engineering at Montana State University. He is a member of the Society of American Military Engineers and the American Society of Civil Engineers. He is an engineer in training in Montana.

Pentagon Warrior:

A dialog with the Deputy Director

by H. Perry Sullivan, Jr.

> "... There is a reason for what we do. We are supporting the strategic, tactical and airlift capabilities essential to our nation's defense. We must shape the Air Force plans, programs, resources and facilities to effectively carry out national policy. It is important that our people understand the history of the Air Force not only in the context of national policy, but the growing importance of Engineering and Services and what we do today, and what we will be doing tomorrow."

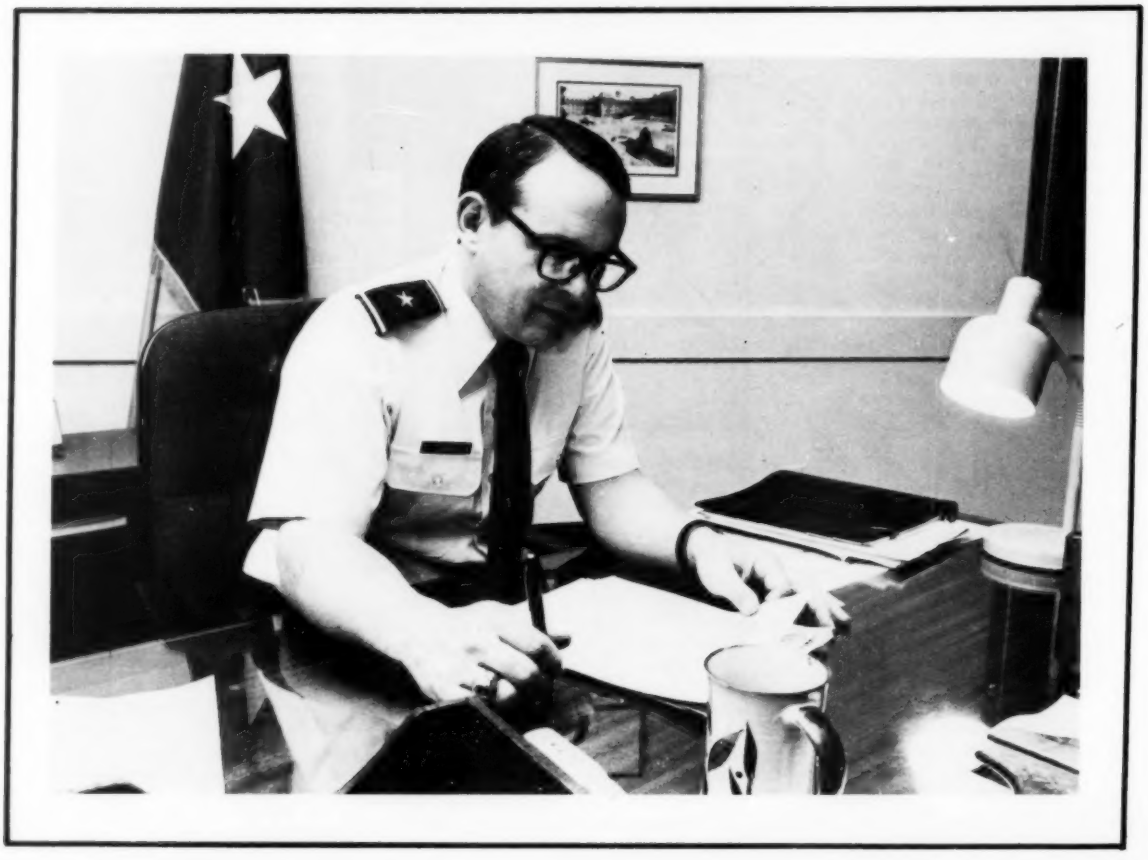
If you create a master equation to determine the U.S. ability to deter a major war, you are measuring the war-fighting capability of the nation and its allies. That is what a potential adversary fears and respects.

Air Force Engineering and Services people play heavily in the equation. Brig. Gen. Melvin G. (Gary) Alkire, Deputy Director, Engineering and Services, sees a significant contribution that begins with programming facilities to meet the future needs of the Air Force; planning, researching and training to recover bases after an attack and generate sorties; helping allies build facilities to support their national interests and regionally stabilize the balance of forces; assuring a stable industrial base to support U.S. forces; providing quality workplaces, living spaces and career motivation to attract and retain the highly qualified people necessary for the national defense; and guarding the resources entrusted to the Air Force to make maximum use of each allocated dollar. But the bottom line is being strong enough to prevent a war, or capable and responsive enough to win.

A Lesson from History

That's why Engineering and Services people need a keen awareness of what it means to operate in a hostile environment.

The most recent "history book" is the Vietnam conflict. General Alkire feels that it is important to study the E&S complex involvement working with civilian contractor as well as with military troop capabilities — both working hard to get the job done. Air Force efforts resulted in building up base facilities and constructing new bases halfway around the world; providing hardened shelters, protecting operational facilities and dormitories, responding to enemy attack with a rapid repair capability; handling crew rescue and fire fighting on structures and aircraft, sometimes amid a hazardous chemical and explosives environment; providing food and shelter for our forces in a hot, humid tropical setting, often under constant threat; doing the grim work of mortuary affairs in a real-world environment.



In many ways, he notes the functions now assigned to E&S came of age, particularly the Prime BEEF and RED HORSE organizations and their importance to the conduct of war.

"There is enough material for new library that the Air Force people of today and tomorrow should study. It should be made available to educate, train and orient our people. Much of what we have achieved in the management of major projects – in Europe, Southwest Asia and the Pacific – is based on the lessons we learned in Southeast Asia."

Construction Management

Getting the job done in distant areas of the world draws heavily upon the corporate and personal experiences of Southeast Asia making E&S people an important part of international treaties and obligations.

At AFLC, General Alkire found himself the designated project manager of the Saudi air facilities programs. The driving force in such projects is sometimes supporting the purchase of weapons systems by friendly nations which require facilities support. Currently there are billions involved, $1.7 billion just for the Saudi projects. Additionally, there are site surveys to identify the most feasible locations for facilities to support the Foreign Military Sales cases handled by AFLC's International Logistics Center, and such far-reaching requirements as posed by the rapid deployment forces.

He cites that E&S expertise was directly tied to the Sinai Peace Treaty between Egypt and Israel. While General Alkire was involved in the Saudi projects, Brig. Gen. Paul T. Hartung (USAF Ret.) was responsible for the Israel project. He functioned as Department of Defense project officer, on-site director, and worked between the E&S Directorate in Washington, the Israeli government, the U.S. Ambassador to Israel, and the Corps of Engineers and their contractors. The initial operational capability date was met on schedule three years later with minimal cost growth while building two complete base facilities in the least-inhabited and most remote region of Israel.

"It is important that we record the achievements of people like General Hartung, and develop a historic base to use in future projects. We're documenting 'lessons learned.' It is important to make a record of what we have done well, what we have learned, and what we can do better. However, I don't mean that we should perpetuate the past. In many ways we rely too much upon what we have learned in the past for ways to do things. We really need to do more than that. We must be innovative. We must constantly press to find better ways to do things."

The Industrial Base

Foreign Military Sales consultancy was a small part of the AFLC/DE responsibility. With $1.7 billion in real estate among but seven bases, Air Force Logistics Command is the "industrial heart of the Air Force," and General Alkire's primary mission was keeping the command's facilities viable. As an illustration, during his tenure the MCP grew from about $58 million to more than $140 million.

Energy is a major budget item, but its security is another issue considering AFLC's role in modifying, maintaining, supplying and "managing" weapon systems and the electronic, electrical, mechanical and hydraulic components essential to them. Energy requirements are many times the needs of a typical Air Force base at each of the installations, and the rising utility costs drive many current programs.

He points out that AFLC's facility energy program has been squeezed and wrung-out over the years, due to the energy crises and rising costs. Yet, as older, inefficient industrial facilities were replaced, many more energy intensive processes were introduced. Working with the AFLC deputy chiefs of staff for Logistics Operations (AFLC/LO) and Maintenance (AFLC/MA), General Alkire's people were able to insure that proposed new industrial facilities get an energy review. AFLC/DE also motivated retrofitting older facilities with energy-wise modifications. The people of AFLC responded superbly, he notes, and the command recorded a nearly 15-percent reduction in energy consumption compared to the 1975 baseline.

Historians note that between the tenures of the late Brig. Gen. Frank G. Barnes, Brig. Gen. Charles W. Lamb (now the Air Force regional Civil Engineer for Ballistic Missile Support), and General Alkire there was a remarkable period of energy innovation at AFLC. General Alkire particularly credits General Lamb with being an energy innovator. Overtures were begun which spanned geothermal exploration, solar retrofit, photo-voltaic, and even electrical vehicles funded by $2.2 million in Department of Energy funding. General Shaw continues that tradition.

Can solar be used in the industrial process? AFLC worked with industry to install and begin testing a solar point-focusing receiver steam capability at Hill AFB that works. Can industry successfully relate to Air Force needs for secure energy availability? There is now authority to enter into an agreement at McClellan AFB, signed in May by James Boatright, the deputy assistant Secretary of the Air Force for Installations, Environment and Safety. This will ultimately permit a municipal utility company to build a peaking power plant on Sacramento Air Logistics Center property. Discussion continues with a private firm to explore the possibility of a geothermal resource at Ogden Air Logistics Center.

Former AFLC commander, Gen. Bryce Poe II (USAF Ret.) started the large snow ball rolling with an objective of achieving "energy self-sufficiency for the industrial processes by the year 2000." Working through the Joint Logistics Commanders, General Alkire was able to get a Department of Defense policy on energy security which now serves as a platform upon which to program required energy systems.

". . . Energy is essential to everything that we do. We must look for assurance of secure energy availability to support our mission. We must begin working with alternate energy sources. There are numerous energy initiatives being studied, some of which bring the private sector into our corner. In some cases we are looking at things today as practical applications that we thought of as radical or exploratory ten years ago. But the bottom line is the secure energy we need at a price that doesn't penalize our effectiveness as a fighting force by taking up an inordinate share of our resources."

The Goals of War

If secure energy availability is of concern to the Air Force depot system, the total base operating platform is of concern to bases overseas. If war comes, a potential enemy will seek to destroy U.S. war-fighting capacity with launching and recovery surfaces, command-control-communications-intelligence systems, and base supporting facilities and materials the primary targets.

Recovering the base immediately following attack to support sorties against the enemy is our number one reason for being, he believes. General Alkire is convinced that we will be spending more time and peacetime capability to be sure we can skillfully execute our wartime task.

Most research is done or coordinated by the laboratory at the Air Force Engineering and Services Center working with other Air Force laboratories. The general supports the funded research done by others of the armed forces, other federal agencies, universities and colleges, and dedicated research contractors. Since the Air Force cannot be funded or staffed to handle every research initiative, the goal is to make use of the highly specialized capabilities available elsewhere upon need, getting high quality research for modest investments.

". . . Immediate recovery of the air base following attack can be done if you have the trained people, the right equipment and the materials to do the job. It also means that we must have survivable facilities to protect our people, our weapons

systems, the equipment we use to restore the base to operations, and the essential services needed by the base for supporting operations. We're also faced with having proper personal protection, and being able to provide food and water to our forces. Finding alternate launch surfaces, handling fire fighting and rescue, cleaning up debris, performing rapid damage assessments are all part of what we do. Each takes research. Then we must put our research to use and deliver the products of research to our field forces and properly train them to make the best use of the new equipment, materials and processes."

The Surge

General Alkire approved participation in a recent exercise (PROUD SABRE '83), in which AFLC's 5,000 E&S force was diminished by removing all uniformed people for simulated deployments. As a result manpower standards were developed, concentrating on stabilizing the civilian CONUS sustaining force.

Among food service people there are not enough in uniformed slots in the CONUS to deploy and meet overseas needs. In the 1960s and '70s manpower slots involved in AFM 26-1 studies were deemed "not military mission essential," then were converted to civilian and studied for contracting. The question is, "When is a position military essential?" General Alkire points out that in wartime or when the position is deployed with a fighting force, it is military essential.

"... There are studies going on which are directed at coming up with solutions for our wartime manpower shortfalls. We are working the problem. The people to do the essential jobs have got to come from somewhere — active duty bluesuiters, the reserve forces, our civilian workforce; and we must consider the role of contractors and their people."

The Task at Hand

With fewer people, more work and tremendous shifts in priority, Air Force people in a high state of readiness cannot be penalized with facilities in poor repair or down for maintenance. To shore up problems and improve the physical plant there is currently much activity throughout the Air Force renewing and rebuilding our facilities, coupled to major military construction program efforts in almost every region.

"... It takes intense followup to get our money applied to the right projects, to get the most for our money, and to get things done right and on time. Our workload has grown tremendously ... our people are doing an exceptional job. One way is by finding better ways to do things."

Data Automation

Throughout the Air Force energetic and eager E&S innovators are emerging who are interested in streamlining work and making management more efficient and effective. Getting the job done without having to grind out as much recurring paperwork or digging through stacks of files for data will be the major motivation for automating the information systems employed by E&S people.

General Alkire credits Brig. Gen. George E. (Jud) Ellis and the Tactical Air Command DE team with answering many of the automated information needs of the Air Force through adroit use of minicomputers which can be used by almost anyone, rather than requiring a dedicated, highly trained computer staff.

General Alkire became a mini-computer supporter in AFLC. Tinker AFB was the first USAF base to acquire a minicomputer as a part of the test. Innovative people — encouraged to work smarter — adapted spare computer capability to automate job order management.

Computerizing AFLC's .O&M functions made it possible to handle the job with existing manpower resources, and support customer needs, while cutting costs. Computer-aided design will make better use of engineering talent, cutting time and money, reducing change orders significantly, and improving accessibility to engineering drawings.

"... Almost weekly I participate in some aspect of the computer acquisition. It holds great promise. The best thing that the computer has going for it is in reducing the drudgery of generating paper. You have the information you need at your fingertips. You can be sure that there will be a terminal in the director's and deputy director's offices, programmed to our needs. Automation of information in the 1980s will ultimately change how we do our peacetime job — a more significant management change than any in our history."

Quality and Competitiveness

A less obvious advantage of the computer is the ability to remain competitive, particularly in the face of "contracting-out" studies. Computers make it possible to track work better, programmed to the individual needs of each branch or unit. That frees worker time and involvement through better sequencing of jobs, ending backlogs caused by slow paper flow, and making "targets of opportunity" more visible, creating efficiencies.

Cutting rework also increases efficiency. Quality circles activities in E&S functions of AFLC, he points out, largely reflect a good command-wide quality program. E&S people get interested and involved, and provide meaningful inputs to their jobs, and identify with the quality and responsiveness of their organization.

Many things done in the name of greater efficiency or economy don't work out to the degree anticipated. He points to the pressure while he was at Air Training Command to centralize all Air Force base maintenance and operations in San Antonio under the San Antonio Real Property Maintenance Agency (SARPMA).

He notes that economic advantages are eroded by the creation of the necessary infrastructure required to support the agency, coupled with the large distances for repair responses. Economic/efficient operations result when decisions are left to the local commanders.

"... The nature of Air Force functional organization is along mission lines — strategic, tactical and airlift, etc. Each commander is provided resources required to support their mission. Even if you are a tenant on a big base, there is a commander-to-commander relationship to get things done. Priorities must be set based on the mission."

Quality and Retention

Quality of life, he feels, is important to mission success. It is instrumental to attracting and retaining a quality force. In Europe, he was assistant deputy chief of staff, Engineering and Services, carrying out many of the projects begun under the late Maj. Gen. Robert C. Thompson. USAFE was a fertile ground in which to plant the seed for reshaping the Air Force philosophy.

However, quality of life is particularly critical at the AFLC bases, with a minority population of bluesuiters. General Alkire's people identified 223 projects worth $39 million, upgrading dormitories, dining halls, visitors' quarters, MWR facilities and even the break rooms in industrial areas. Nearly $10 million improved base exchanges and commissaries; and the banks and credit unions using government-owned facilities.

Improvement without unity of design can destroy the overall effect. A sense of direction and unity can enhance the image and sense of identity with Air Force bases. At Air Training Command he initiated a program to identify the architectural characteristics of each base as an aid to architects and engineers. Paint schemes and sinage in good taste and design were made consistent with Air Force policy. At AFLC, he created an interior design consultant's position to make order out of the alternating images of vintage GSA drabness and chaotic attempts to copy Amtrack-modern interior design.

He brought the Air Force Clothing and Textile Office in Philadelphia back under the

New Commander Installed at HQ AFESC

The fourth commander in its five-year history was installed at the Air Force Engineering and Services Center, Tyndall AFB, Fla., in formal ceremonies July 1 before Brig. Gen. Melvin G. (Gary) Alkire, deputy director, Engineering and Services, HQ USAF.

Col. Joseph T. Callahan Jr., formerly the vice commander, succeeded Col. Ernest D. (Dale) Strait, commander of the center since July, 1981. Colonel Strait retired from active duty.

Colonel Callahan came to the center from Riyadh, Saudi Arabia, where he served as construction program manager on facility programs for the Royal Saudi Air Force. He first came to the center as chief of the Energy Group.

A native of Winchester, Mass., Colonel Callahan holds the bachelor of science degree in Civil Engineering from Tufts University. He also earned the master of engineering degree in Civil Engineering from Texas A&M University under the Air Force Institute of Technology.

He holds both navigator's and pilot's aeronautical ratings and has flown the Strategic Air Command and Military Airlift Command.

Key civil engineering assignments include Wakkani Air Station, Japan; Norton AFB, Calif.; Scott AFB, Ill.; and Kirtland AFB, N.M., before moving to Saudi Arabia.

Colonel Strait, a native of Billings, Mont., received the bachelor of architecture degree from the Massachusetts Institute of Technology, and later earned the master of science degree in Engineering at Stanford Univeristy under AFIT. Key assignments include Greenland, France, the Space and Missile Test Organization, the AFIT School of Civil Engineering, Myrtle Beach AFB, S.C., and both HQ Pacific Air Forces and U.S. Air Forces in Europe.

Upon retirement Col. Strait received the Legion of Merit with second Oak Leaf Cluster honoring his achievements.

He guided a $10 million rapid runway repair research and development effort providing an air base damage assessment system, configuring heavy construction equipment for a chemical environment and utilizing local materials to produce a flush repair. He expanded the Eglin AFB, Fla., training site for Prime BEEF and Prime

RIBS. During his tenure new built-up roof specifications were developed. Use of this inventive program resulted in a savings of $6 million. For this the Construction Specification Institute recognized the Air Force with the National Citation Award.

In the area of energy, Colonel Strait directed the initiation of a new office to intervene before the public utility commissions when excessive utility rate increases were proposed. Through 42 interventions, this office successfully saved the Air Force $20 million per year. The Air Force Facility Energy Plan was revamped and now is the most comprehensive plan since the energy crisis began in 1973.

management of AFLC/DE, and worked with the commanders of AFLC and the Air Force Systems Command to create a USAF uniform steering group and initiated efforts to get a formal uniform training program online at Lowry Technical Training Center and at the textile office. As a result, development acquisition, distribution, handling of deficiency reports, and availability at local clothing sales stores are all greatly improved.

"... We want to promote a sense of identity and pride. Not only do we want our people to feel that their living conditions do not sacrifice quality, but we want them to feel good about the conditions of their workplace. The people who live on our bases should feel a sense of pride in their quarters. We want our people to be proud of their uniform. If our people feel good about being a part of the Air Force they each will put a part of themselves into making the Air Force a better place."

PEOPLE

Maj. Ernest O. (Ernie) Robbins II succeeds **Lt. Col. Charles O. Walls III** as executive to the director in Washington. Colonel Walls moves to join the TAC/DEH team of **Lt. Col. Roy Kennington.**

Col. John A. Johnson is the new vice commander for the Lowry Technical Training Center, Lowry AFB, Colo. He currently is deputy director for International Programs, DCS Programs and Resources, HQ USAF.

Maj. Gen. Perry M. Smith, director of plans, DCS/Plans and Operations, HQ USAF, will become the new commandant of the National War College, Ft. Lesley J. McNair, Washington, D.C.

Capt. Dean Fox succeeds **Lt. Col. Joe Lonki** as executive to the deputy director. Colonel Lonki moves to Peterson AFB, Colo.

New president of the Society of American Military Engineers is **Rear Admiral William M. Zobel,** commander, Naval Facilities Engineering headquarters. He succeeds **Lt. Gen. Joseph K. Bratton,** Chief of Engineers, U.S. Army. **Maj. Gen. Clifton D. Wright Jr.,** Director of Engineering and Services, HQ USAF/LEE, was named vice president. **Brig. Gen. Sheldon J. Lustig,** deputy chief of staff, Engineering and Services, HQ USAFE, was awarded the Newman Medal for outstanding contributions to Air Force civil engineering. The SAME convention was held April 27-30 at St. Louis.

General Wright was installed as a member of the American Institute of Architects during the AIA convention in New Orleans May 22-25, joining 12 other distinguished architects installed to honorary membership. General Wright was the only recipient of the honor to represent the armed forces.

Project Warrior

COMISO: GLCM at the crossroad of history

by Maj. Jack T. Baker and Sgt. Lea Blake

In December of 1979 the NATO Foreign and Defense Ministers decided that a dual-tracked response to the Warsaw Pact's build-up of long-range theater nuclear forces was needed. In addition to arms limitation negotiations, they voted to deploy 108 Pershing II missiles and 464 ground launched cruise missiles in Europe. Five European nations agreed to host GLCM; they were the United Kingdom, Germany, Belgium, the Netherlands and Italy. RAF Greenham Common, The United Kingdom, will be the first site to become operational. Comiso, the Italian site, will be the second.

During World War II Comiso was a German occupied site. It is located on the southeast corner of Sicily. During its occupation soldiers slept, ate and practiced the art of war within its buildings. Comiso, by historical accounts, was the site of launching the Axis powers in North Africa and the Allied invasion into Sicily and Italy. One story, however, didn't come from a history book but from 55-year old Antonio DeGuardo who is a member of the Italian Air Force. He was a little boy during the bombing of this German Air Base and tells his story this way:

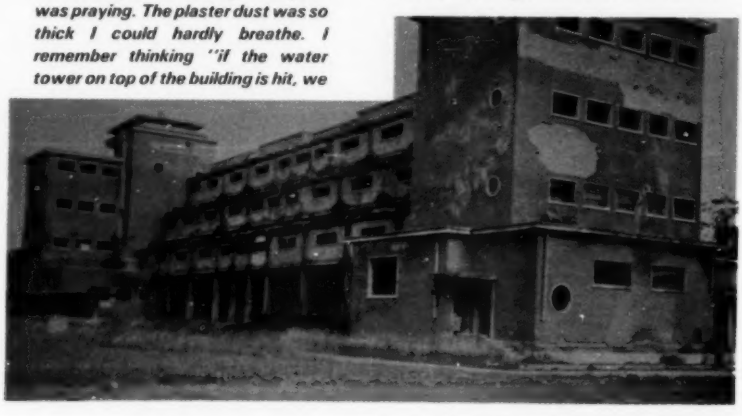
It was beautiful out, warm and sunny. Food was scarce in Sicily during the war so I carried a knife and fork in my back pocket in case the soldiers gave me something to eat. It was nearly noon. Some of the other boys were standing at the food wagon in front of the barracks. I was sitting on the steps eating.

Normally we would be over by the pool watching the officers swim or at the airfield looking at airplanes, but on this day Signor DiPietro, one of the supervisors, told us to stay near the barracks. I guess he had a premonition that something would happen.

Suddenly the sky became very dark and I heard the sounds of American bombers as they roared in from the south. Then the bombs fell. My friends, I and hundreds of soldiers raced inside the barracks and down the stairs to the basement. As I crouched in the dark with my back against the wall, I could feel the concussion in my belly as the bombs exploded nearby. Everyone was praying. The plaster dust was so thick I could hardly breathe. I remember thinking "if the water tower on top of the building is hit, we will all drown." Once, when the bombing stopped for a few minutes, we started to leave but someone shouted "Wait! The planes will make another attack." Thank God we waited. It came, then it was over. When I went outside I saw the damage and for the first time was afraid.

Within a few days the allied forces took the base.

The history books are interesting — exciting. DeGuardo's account of the first bombing on the site is priceless. But, even more descriptive is the account left on the walls of the Comiso barracks — graffiti — German, American and Italian graffiti. Artwork, drawings, cartoons, and murals —



testimony to what the base had been and seen. This was all that was left of the former occupants.

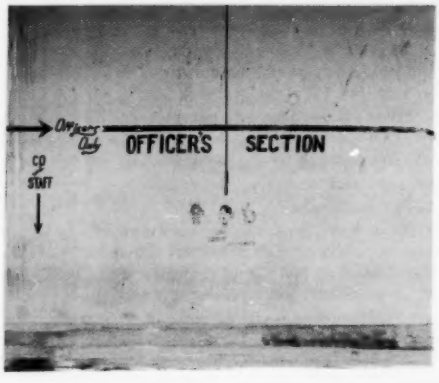
Now all that is left of their testimony are the particles of dust rising from a demolition crew and a few photos and slides taken by enthusiastic amateur historians and collectors.

The barracks housing these artifacts have been torn down to make room for new construction as Comiso opens its doors once more to men and women in uniform.

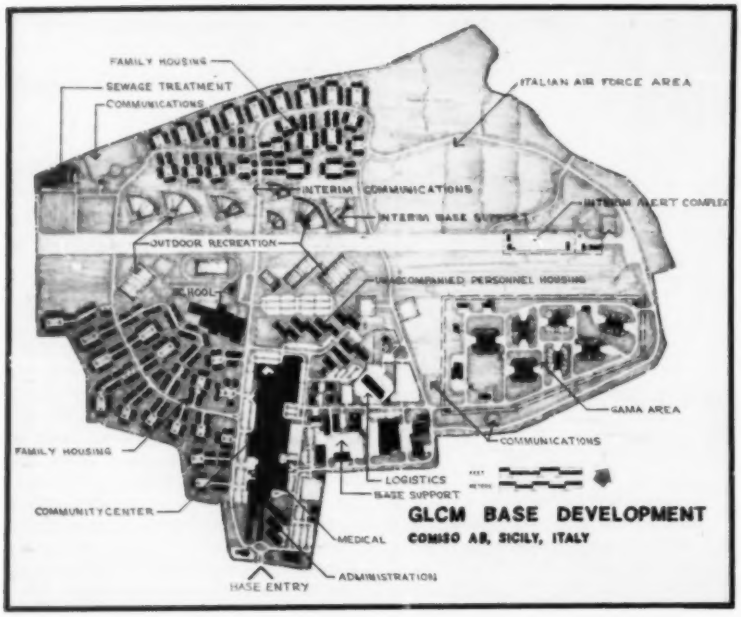
The GLCM site is to become the home of seven flights of missiles and a base population of more than 2,000 Air Force people. More than $200 million worth of new facilities will be constructed during the next two to three years. This massive construction effort is being orchestrated by Headquarters U.S. Air Forces in Europe (USAFE) Engineering and Services through the Navy's Office in Charge of Construction for the Military Construction Program and the host nation for the NATO facilities. Hardened shelters for the GLCM vehicles, extremely tight timeliness, and any number of political issues makes this one of the most challenging construction projects ever undertaken by the Air Force.

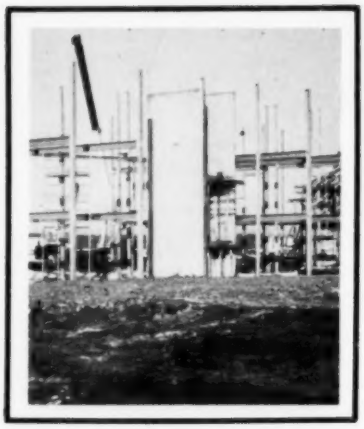
The first facilities (dorms, dining hall, ad-

OPPOSITE PAGE TOP: Main enlisted domitory where the majority of the graffiti was found.



OPPOSITE PAGE and ABOVE: Detail of large mural on opposite page.





ABOVE: One of the first facilities, an accompanied enlisted personnel domitory, is under construction and scheduled for completion in August 1983.
BELOW: Close-up of one wall section.

ministrative and support buildings) were started in September of 1982. As new construction transforms the base, the next chapter of its history will be written by the men and women of the 487th Tactical Missile Wing. The first of those people have arrived and are preparing the base to support the operational personnel that will arrive later. Communicators will be installing equipment, transporters and logisticians will be bringing in supplies. The Security Police will be setting up their operations and engineering and services will be there to make sure everyone has a place to work, eat and sleep.

Services will be operating the dining hall, handling billeting (both on and off base) and working the hundreds of issues that will come up as they prepare to receive more and more people. The engineers will be monitoring the massive construction effort (along with the OICC people already on-site), setting up the base civil engineering organization, establishing service contracts, making sure the generators are working and responding to that first service call from the dining hall.

For those from the E&S community at Comiso, the job is difficult, the hours long, but the total effort rewarding. Comiso will be a very visible and important place because those assigned are involved in building a base destined to play a major role in NATO's efforts to maintain its defensive posture.

Maj. Jack Baker is assigned to the Readiness Directorate of HQ USAFE/DE. He holds the bachelors and masters degrees in Industrial Engineering from Ohio State University. He holds the masters in Business Administration from Wright State University, Dayton, Ohio. He is a registered professional engineer in Ohio.

CESMET tips

The Air Force Civil Engineering and Services Management Evaluation Team (CESMET) reviews, evaluates and assists base civil engineering and services functional areas in accomplishing their mission in the most effective and efficient manner. This department is designed to pass along new ways to do the job better.

Civil Engineering

Job orders are big business, and at many bases they take up to 50% of the BCE's direct manhours. Yet, most bases must still use a manual system to manage and control their job orders and will continue to do so until WIMS comes on-line. To insure accurate backlog data and reduce the number of delinquent job orders, we recommend the following steps:

- Separate completed job order log sheets from those that still contain open job orders.
- Continually consolidate open job orders onto new log sheets in a "consolidated log." With 20 job orders on a log sheet, a 600 job order backlog will go on only 30 sheets, an easy number to manage.
- Have Material Control provide Customer Service a monthly listing of job orders that are 100% material complete. The list should be in job order number sequence to match the logs. Compare the list to the logs and check out all descrepancies. Be sure to look at those which the log says are material complete but are not on the list.
- At least once each quarter, have Material Control provide Customer Service a list of job orders, in job order number sequence, that are awaiting materials. Reconcile the list with the logs.
- At least monthly have the Controllers provide Customer Service a list of all job orders in their consoles if they are not returning all uncompleted job orders on a weekly basis.
- For an accurate count, use the log to count the backlog, not the hard copies of the job orders.
- Concentrate on and brief your 10 oldest jobs in each category: E, U, and R; awaiting material/awaiting manhours.
- Put EPS estimates on your old job orders and schedule them by day, just as you do work orders, to insure they are done. Remember, the key words are consolidate and reconcile. The goal is to meet customer commitments, reduce delinquent job order backlogs, and provide managers with more accurate data.

Budget

During our recent trip to PACAF, we saw an excellent plan at Kadena AB which integrated cost and financial management. Mr. Sid Rhodes, Funds Manager for the 18CSG Civil Engineering, sees a windfall benefit from the reorganization. His comments follow:

> As we studied the impacts of the reorganization on personnel assignments and workload, an unexpected benefit became more apparent. The reorganization allowed the realignment of duties to improve CE financial operations. The analyst responsible for the reimbursement program, for example, was also responsible for shop rates, a primary source of reimbursement earnings. The cost analyst responsible for General/Flag Office Quarters reporting also processed facility projects by contract for GOQs. Duties were diversified to enable the most attention to critical programs and to provide for a balance of workload among the analysts. These assignments were then published and distributed within Civil Engineering for maximum accessibility to the analysts and improved financial management assistance.
>
> The reorganization culminated in the improved technical and professional development of cost and budget analysts and enhanced the interaction of budgeting and accounting processes for more effective financial management. For Civil Engineering Financial Management at Kadena AF, Japan, implementation of the reorganization became more than a higher headquarters mandate — it was implemented with the enthusiastic support of management and cost and budget analysts because of these windfall benefits.

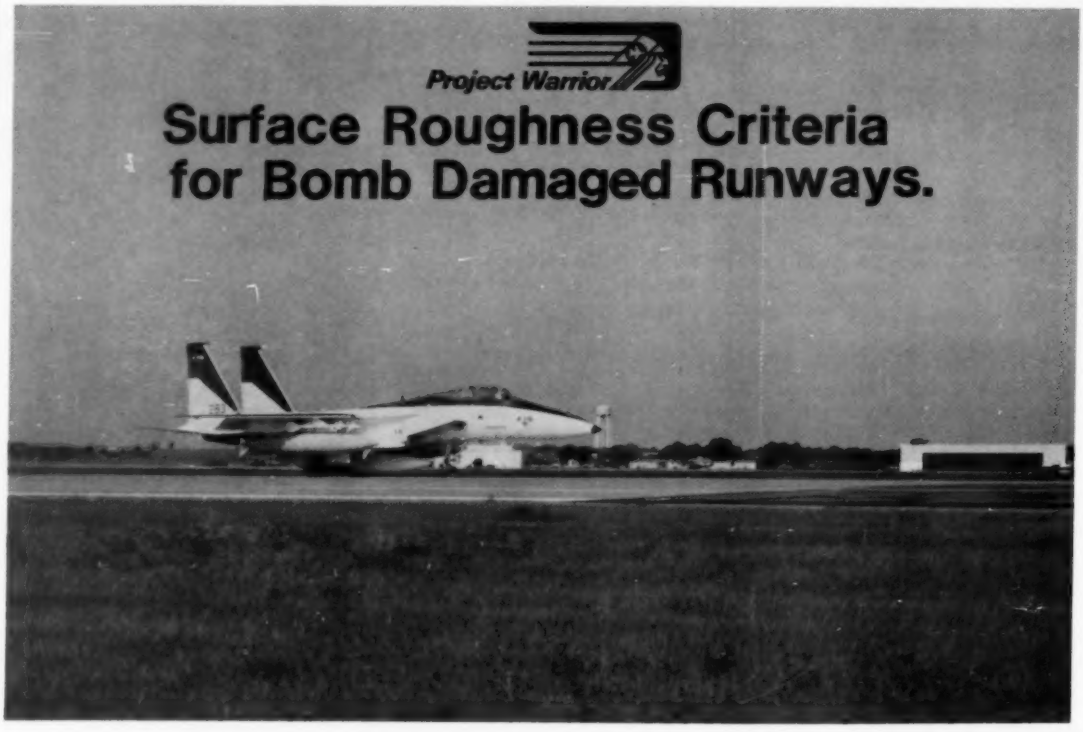
We believe this approach is applicable for all fund management sections, regardless of size. For more tips on how they did it, call Mr. Sid Rhodes, 18CSG/DEM, AUTOVON 634-1552/3424.

Contracting

The Quality Assurance Evaluation (QAE) program for service contracts continues to receive emphasis throughout the Air Force. This program ensures that we receive quality service in contracted-out functions. Since personnel turnover is inevitable, training must occur frequently. We have recently seen the following training concept work well at several bases. First, a training handout is sent to a designated QAE a week prior to the formal training session at base contracting. Then, the formal one-half day or so training occurs using the slide/tape approach. Next, the QAE spends about two hours with "his/her" contract and the contract administrator. After about a week on the job, the QAE returns for another two-hour session with the contract administrator to resolve gray areas and issues in the contract. This plan works! Ask your base contracting office if they may be able to use this approach to further enhance your QAE training program.

Project Warrior

Surface Roughness Criteria for Bomb Damaged Runways.



by W.S. Strickland and Evelyn Schall

It is axiomatic that, in designing around one problem, one is apt to uncover another. So it is that the development of aircraft shelters and other hardened airbase facilities leaves the runways themselves as attractive targets for enemy attack. If a nonnuclear attack is launched against our airbases in Europe, commanders will be faced with launching and recovering aircraft from damaged runways. The Rapid Runway Repair (RRR) program, managed by the Air Force Engineering and Services Center (AFESC/RDCR) at Tyndall AFB, Fla., was established to provide commanders with the tools, materials, and plans for rapid re-establishment of air operations.

The RRR program is multi-faceted. It encompasses damage assessment, minimum aircraft operations surface selection, damage repair, emplacement of visual aids and navigational aids systems, and necessary maintenance for continued sortie generation. These tasks become exceptionally difficult in the post attack environment which may include chemical/biological invasion and unexploded ordnance. Fortunately, the tasks are only exceptionally difficult and not impossible. The time required to establish sortie generation is critical if an airbase is to meet its mission. The key word in the RRR goal is "rapid."

In general, the rapidity with which sortie generation can be established depends upon how much damage must be repaired and how smooth the repairs must be (quantity and quality). The rougher the surface that can be used for aircraft operations, the less time it will take to prepare. Surface roughness criteria (SRC) answer the question, "How much roughness can our operational aircraft tolerate?"

Sources of Surface Roughness

To appreciate the roughness that is likely to be encountered, some understanding of the threat of associated damage mechanisms is required. The principal threat to airfield pavements is the general purpose bomb or airfield attack weapons. Both devices are designed to penetrate the pavement and explode just inside the subgrade. The effects of such weapons produce a crater in the runway, and an associated pavement movement around the crater periphery called upheaval (shown in Figure 1).

Various expedient repair techniques, such as crushed stone, AM-2 matting, polymer cap systems, or precast concrete slabs, are currently in use or under research and development. Each of these techniques imposes some degree of roughness in the repaired crater area.

To provide a level surface for aircraft operations one must use a repair technique providing level surface across the crater, remove all upheaval, and assure that any covering used is of insignificant thickness. Removal of all upheaval, itself a time consuming task, increases repair time and material requirements due to the larger cavity the crater presents for filling. By establishing aircraft tolerance to operations over upheaval and the roughness resulting from various repair modes, one may reduce the repair time and material.

Methodology for Establishing Criteria

The approach to development of surface roughness criteria consists of three main tasks:

- Aircraft simulation computer program synthesis;
- Aircraft testing to validate the computer program; and
- Analysis to determine aircraft tolerance to operations over various surface

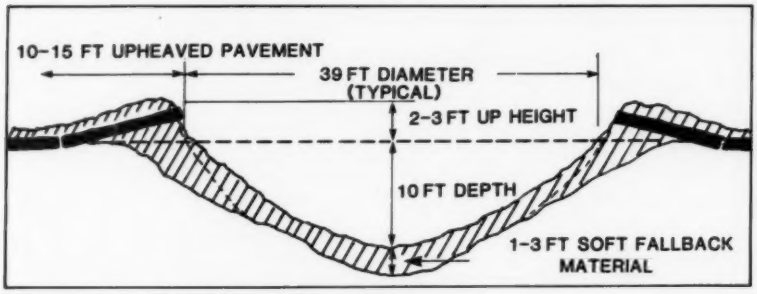


Figure 1: Typical 750-pound bomb crater

profiles.

The first two tasks are managed under the HAVE BOUNCE program by the Aeronautical Systems Division (ASD) at Wright-Patterson AFB, Ohio. The latter is performed at Tyndall AFB.

Typically, the aircraft simulation computer program is synthesized by the airframe manufacturer under contract to ASD. The computer program must be capable of predicting dynamic loads in aircraft structure (particularly landing gear and attachment structure) due to operation over rough surfaces. The model is nonlinear and includes the predominant flexible modes of the aircraft.

Aircraft testing is usually accomplished by the Air Force Flight Test Center at Edwards AFB, Calif., under a memorandum of understanding with ASD, although other arrangements are occasionally made. The test aircraft is instrumented with strain gauges, accelerometers, and pressure gauges at critical positions in the structure and landing gear struts. These critical components are monitored during taxi, takeoff, and landing operations over simulated repair profiles. The test data are then used to validate the computer simulation model.

Aircraft analysis involves using the validated computer model to compute structural responses to operation over a variety of surface profiles for various aircraft configurations and operating regimes. Surface profiles may be described in terms of parameters such as:

- Repair upheaval height, repair length, and repair spacing;
- Aircraft configurations by weight, center of gravity position, aerodynamic control surface deflections, and power setting; and
- Aircraft operating regimes by constant speed, accelerating or decelerating taxi, or braked roll.

An array is formed of the various reasonable values that may be assumed by each of the parameters:

- Surface profile,
- Aircraft configuration, and
- Aircraft operating regime.

Aircraft configuration, and aircraft operating regime parameters may be assumed. Analyses are performed over a range of aircraft ground speeds for each element of interest in that array. Comparison of aircraft component responses to component allowables determines repair qualities over which the aircraft can operate in various configurations. Aircraft structural and landing gear damping times may lead to imposition of repair spacing limitations.

Surface Roughness Criteria

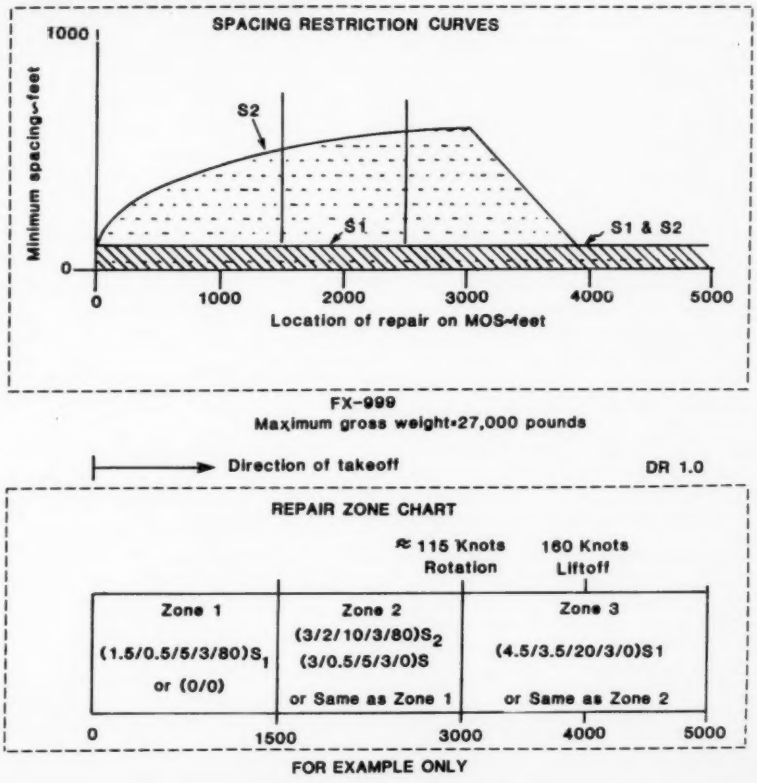
SRC are defined by two groups of data – the first concerning repair quality, the second concerning repair spacing. They are presented graphically by a repair zone chart (bottom of Figure 2) and spacing restriction curves (top of Figure 2).

Comparisons among repair quality requirements, aircraft velocity and expected position on the MOS allow the setting of repair zones along the length of a MOS. Repair quality requirements are specified within each of the zones in terms of five parameters: maximum upheaval, nominal sag, a span associated with the sag, maximum change in slope, and maximum repair length (Figure 3).

In the representative unidirectional fighter MOS of Figure 2, the repair qualities are written within a set of parentheses in the individual zones. These are the allowable maximum values of the five parameters previously mentioned. Thus, Zone 1 in the representative criteria indicates a criterion of (1.5/0.5/5/3/80) which allows 1.5-inch upheaval, 0.5-inch nominal sag, a 5-foot sag span, a 3-percent change in slope, and a maximum repair length of 80 feet. The sag span is the maximum distance over which the sag can exceed the nominal sag value by 0.5 inch. The (0,0) criterion in Zone 1 is a convenient notation for a flush repair without upheaval and sag.

The second group of data is a set of spacing curves defining the minimum distance between multiple repairs. Spacing is the

Figure 2: Example of takeoff SRC



distance, along the aircraft path, between repairs. No part of either repair is included. In the example of Figure 2, if there is a (3/2/10/3/80) quality repair located at the 2,000-foot point of the MOS, the minimum distance allowable to the next repair, read from curve S2, is 550 feet. Moving in the direction of travel, the next repair may occur no sooner than the 2,550-foot point.

This information is necessary to allow the timespan, in which the aircraft responds to a repair, to damp out before the aircraft encounters a second repair thus preventing reinforcement of responses. Spacing requirements may be reduced if repairs in a given zone can be upgraded to a smoother profile. If more than one spacing curve is shown, they are labeled and the applicable curve designated at the end of the parentheses. For example, in Zone 2 of Figure 3, the S2 spacing curve applies to the repair quality for that zone, (3/2/10/6/80)S2.

Use of SRC

The criteria described above are not designed to be used by the teams making repairs, but are inputs into the selection of the MOS after attack. The criteria will define to the civil engineers the quality of repairs that must be made. The SRC for all aircraft must eventually be integrated into a format suitable for multi-class aircraft operations. The use of parameters such as upheaval, sag, sag span, slope and repair length in the criteria have been chosen to make their use acceptable to repair teams in a wartime environment.

Status of the SRC Effort

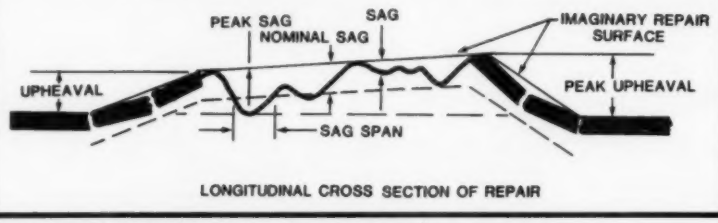
The RRR program plan is to develop SRC for 10 aircraft: F-4, C-141B, C-130, F-15, C5A, F-16, A-10, F-111, DC-10, and Boeing 747. To date, criteria have been developed for the F-4, C141B and C-130 aircraft. HAVE BOUNCE testing has been completed for these aircraft, and for the F-15 and C5A. In addition, preliminary analyses have been performed on all but the Civil Reserve Aircraft Fleet class aircraft (the DC-10 and Boeing 747).

Summary

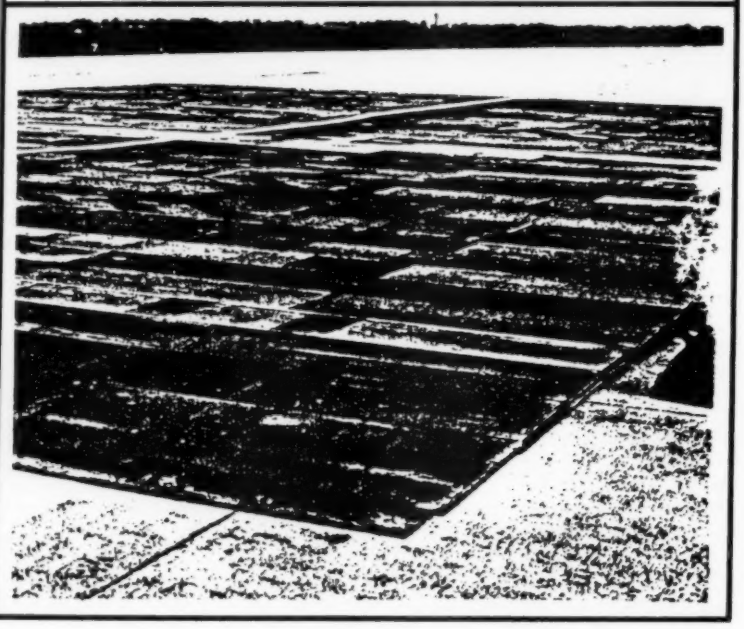
Of the fighter class aircraft, the F-4 appears to be the least tolerant to operations over surface roughness. Preliminary analyses show that, other than in the landing touchdown zone, SRC for F-15, F-16 and A-10 aircraft will be less stringent. In general repairs must be of high quality on the first part of the MOS, and can become rougher down the length of the 5,000-foot strip.

Airbase recovery following non-nuclear attack will be a test of our capability to assess and repair damage as required to reestablish air operations, expeditiously. The use of SRC will decrease the time and resources required for base recovery, enhancing the Air Force ability to respond to enemy attack.

Figure 3: Repair nomenclature



LONGITUDINAL CROSS SECTION OF REPAIR



W.S. Strickland is the program manager for Post-Attack Operations and Testing for the Engineering and Services Center. He earned a bachelor of sciences degree in Mechanical Engineering at Southern Methodist University and a master of sciences degree at The University of Florida in Engineering Science and Mechanics. He went to the center from the USAF Armament Laboratory, Eglin AFB, Fla. He previously worked for Martin-Marietta.

Evelyn Schall earned her bachelor of arts degree in Physics and the master of sciences degree in Engineering Mechanics at Wichita State University. Additionally, she did doctoral-level graduate work in aeronautical engineering under a joint program of Wichita State and the University of Kansas. Before joining the BDM Corporation at Panama City, Fla., as the senior dynamicist, she was a Structures Group Engineer at Cessna Aircraft Co., Wichita. Prior to that she was a structural dynamicist with the Boeing Co., Wichita.

tecnotes

BACKFLOW PREVENTION PROGRAM (BPP) — AFM 85-21, which outlines this program, has been changed to allow for the exclusion of military family housing. Device inspection periods have been doubled, and vacuum breakers are now permitted on irrigation systems regardless of the hazard classification. (AFESC/DEMM, Mr. Mumme, AUTOVON 970-6373)

APPLICATION GUIDE FOR WASTE HEAT RECOVERY WITH ORGANIC RANKINE CYCLE EQUIPMENT — This study conducted by the Jet Propulsion Laboratory (JPL) for AFESC/DEB looks at the current state of the art in organic rankine cycle equipment. It also provides a quick method to determine if ORC equipment would be cost effective to recover energy from a waste heat source. This report will be published as an Energy Techdata Sheet later this summer. (AFESC/DEB, Mr. Beason, AUTOVON 970-6461)

SERVICES INFORMATION MANAGEMENT SYSTEM (SIMS) — An initiative has begun to combine and expand the Automated Food Service Operations System (AFSOS) and the Automated Billeting and Reservation System (ABARS) into SIMS. The new system will also incorporate the functions of the chief of services, administration and operations, mortuary affairs, linen exchange and housing supply. Continued improvements in computer software and hardware make the new system possible within the funding levels already established for AFSOS and ABARS. SIMS acquisition will be a part of the civil engineering Work Information Management System (WIMS) procurement. (AFESC/DEH, Capt. Cox, AUTOVON 970-6205)

HEAT EXCHANGER DESCALING — CALMAL-22, a product of AC Ltd., North Miami Beach, Fla., shows promise in descaling shell and tube heat exchangers. This product is purportedly fast-acting and safe when handled in accordance with manufacturer instructions, and effectively removes scale with minimum corrosive effect on the metal. (AFESC/DEMM, Mr. Mixon, AUTOVON 970-6342)

BIRD SCARE CARTRIDGE AVAILABILITY FOR AIRFIELD BIRD CONTROL — The availability of an effective bird scare cartridge is essential for the safety and well being of USAF aircraft and aircrews worldwide. Headquarters Air Force Logistics Command is in the process of changing procurement procedures for the cartridge from local purchase to central procurement and funding. To insure uninterrupted support of bird scare devices, the Ogden Air Logistics Center, Hill AFB, Utah, (OO-ALC/MMW) will support all MAJCOMs and using Air Force agencies. Bases are authorized to locally purchase minimum quantities of cartridges pending delivery of centrally procured stock estimated for April 1984. Non-CONUS activities may request local purchase support through the Utah center. Refer requirements for support assistance to OO-ALC/MMWDC. (AFESC/DEVN, Maj. Long, AUTOVON 970-6234)

ANALYSIS OF SOILS CONTAMINATED WITH PCBs — Could soon become a routine field task with the methods being developed by the ESL. The ESL method would provide qualitative results in 15 minutes or less enabling emergency response teams to make on the spot decisions as to actions necessary. The method uses a commercially available, portable PCB test kit for transformer oils that can analyze samples in five minutes for about one-eighth the present cost. (AFESC/RDVW. Lt. Aldrich, AUTOVON 970-2942).

ALTERNATE SURFACE AND BOMB DAMAGE REPAIR (BDR) TEST — In August 1983, North Auxiliary Field, S.C., will be the site for testing two alternate surfaces (thin asphalt and stabilized soil) and two bomb damage repair systems, (polyurethane cover over crushed stone and precast concrete slabs over ballast stone). Surfaces will receive severe dynamic testing from F-4 braking, touch and go operations, sharp turning, and afterburner. Test data will be used to decide the final design of the alternate surfaces to be constructed as Spangdahlem AB, Germany, in 1984. (AFESC/RDCR, Capt. Ruschmann, AUTOVON 970-6329).

HAVE BOUNCE TESTING — A-10 HAVE BOUNCE testing began June 13 at Edwards AFB, Fla. Approximately 90 taxi, takeoff, and landing runs are planned over three different repair profiles. Upon completion of A-10 tests (about July 15, F-16 HAVE BOUNCE testing will commence. During these tests, ground clearance of the F-16 centerline tank will also be investigated. (AFESC/RDCR, Capt. Pearson, AUTOVON 970-6328).

England and Yokota AFB's Take Hennessy Honors

by Sgt. Lea Blake
Associate Editor

Air Force dining halls have come a long way — from the cardboard and plaster of World War II to the stainless steel and microwave ovens and computerized menus of the 80s. Today our dining halls are constantly changing — being rebuilt and redesigned. As Col. Robert S. Deas, 23rd Combat Support Group commander, England AFB, La., said, "Despite continued reductions in operating budgets, military dining facilities have come a long way from C-rations and powdered eggs in the ***chow hall*** of the early 1950s. The majority of these improvements were made to upgrade the service — new ceiling fans and carpeting in the dining areas — these ideas were taken from our civilian counterparts."

Colonel Deas should know — his dining hall, the Chennault Inn, took the top award in this year's Hennessy Awards Program (single unit category representing Tactical Air Command).

Yokota AB, Japan (Pacific Air Forces), won in the multiple unit category and the 440th Communications Security Squadron Food Service Activity, General Billy Mitchell Field, Wisc., won the special recognition category for an Air Force Reserve unit.

Runners-up were Vance AFB, Okla. (Air Training Command), in the single unit category; and Tempelhof Central Airport, Germany (U.S. Air Forces in Europe) in the multiple unit category.

Other nominees were Hanscom AFB, Mass. (Air Force Systems Command); the 5940th Electronic Security Wing, Ft. Meade, Md. (Electronic Security Command); Dover AFB, Del. (Military Airlift Command); Anderson AFB, Guam (Strategic Air Command); RAF Fairford, The United Kingdom (USAFE); Eielson AFB, Alaska (Alaskan Air Command); Chanute AFB, Ill. (ATC); Malmstrom AFB, Mont. (SAC); and George AFB, Calif. (TAC).

Secretary of State, Verne Orr presenting Hennessy trophy to winners.

Winners were selected from dining halls all over the world. Competition began during the fall when MAJCOMs made their decisions as to which facilities they would nominate.

A team of two civilians from the civilian food service organizations and one military service officer for each category visited and inspected those nominated. A point system covering 12 areas, including food preparation, management and customer acceptability, was used in the evaluations.

Besides being skittish about getting on a set of weight scales after touring nominated bases, both teams came away from the competition with a higher opinion of Air Force food services. Kay Stammers of Rochester, N.Y., corporate food service manager for Eastman Kodak Co., and a member of the board of directors for the Society for Food Service Management said, "I was pleasantly surprised in the Air Force's food service. I've learned a lot about the Air Force." With regards to the program Stammers said, "(it) serves as one of the Air Force's primary motivation tools to improve food service."

Hennessy Trophy Multiple Runner-up, Tempelhof, Germany.

The program was named in honor of the man who started making the changes in our dining halls. John L. Hennessy was asked by President Eisenhower to assist the Department of Defense with his advice and assistance in solving food service problems of facility design, training and money management. Hennessy, one of the nation's best known restaurant executives, died in 1955.

Since the first competition, the program has motivated Air Force food service people to excel. With the help of the National Restaurant Association, the Society for Food Service Management and the International Food Service Executives, the Air Force annually establishes this firm resolve in the minds of its food services personnel.

This year's team included Stammers, Harry Knowles Jr., a member of the board of directors for the NRA, owner/operator of the Manor Restaurant, West Orange, N.J. and the Ram's Head Inn near Atlantic City; Karl Ratzsch Jr., also a member of the board of directors of NRA, president and owner of Karl Ratzsch's Restaurant and the Fox and Hounds Restaurant, Milwaukee, Wisc. and Edwin D. O'Sullivan, member of the International Food Service Executives Association who is presently with the Port Authority of New York and New Jersey as assistant manager responsible for serving more than one million people annually.

The military team members were Captains David B. White and James H. Cox Jr., both with the Air Force Engineering and Services Center, Tyndall AFB, Fla.

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